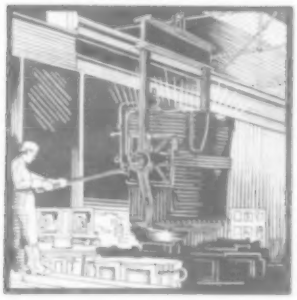
THE FOUNDRY

Established in 1892



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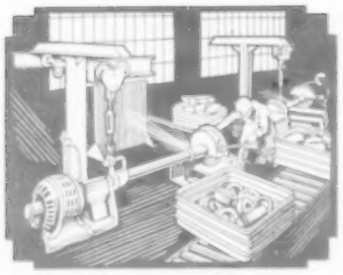


THE FOUNDRY for October

Digging With the HANDS

MANY misguided souls with sentiment addling their alleged intellects are away full cry following the hard labor fallacy. Public projects instigated to provide work for the casualties of the depression are being contracted with the stipulation that labor saving machinery shall *not* be employed. Road repairs and new construction conducted on the pick and shovel plan undoubtedly cost more and the deferred debt adds to the tax burden. Someone must pay for the present day throwback to the past century. Manufacturers of machines and equipment for doing this class of work must if this theory is carried to its full conclusion, permanently surrender their employes to join the ranks of those assigned to hand labor on the roads. Those who sincerely believe that the way out lies through abandoning machinery, should in all honesty scrap their cars, disconnect the refrigerator, throw away sweeper, washing machine and ironer. Then with clumsy futility let them endeavor to spin, weave, hew wood and draw water and by the light of feeble candle compose some remarks upon consistency.

Still Waiting FOR WHAT?

NATURAL caution prevents manufacturers from announcing a new device or product until it has been thoroughly tested. Get the bugs out first, is a sound precept in introducing a new line. Many, during the period of slack business, have been busy perfecting new products. The times have given incentive to diligent search for new uses and applications and a wide range of developments may be expected from manufacturers in the reconstruction period. Reluctance to announce these innovations is apparent. This slowness is not due to lack of faith in the new developments. Until the past few months, lack of action might have been ascribed to the blight of business stagnation and the restraining hand of panic sentiment. Today, this does not hold. Many hesitate from quite another reason. They wish to see some general movement in industry; to observe other announcements and then they will join the crowd. And crowd it may be, including perhaps competitors. Keeping a perfected new development under cover until many are clamoring for attention is not good salesmanship.

Your Own ADVANTAGE

THE way to finish is stop, and the way to begin is to start. Trite but true advice, this, applied to any undertaking. Those who have managed to pull their business through the depression to this point have looked in the main to retrenchment, saving, cutting, paring; all are negative activities that serve to save outlay. All look now to finding a way out. The way to finish is to stop all the negative action that leads only along the downward slope of the curves of production and profit. The way to begin is to start. Rehabilitation of plant and equipment, a work which by no means has been neglected in the foundry industry can be carried on to completion. Improved operation is necessary and vitally important to those who would build back. Low prices today make purchases of machinery, materials and supplies available on terms that give the far seeing buyer an opportunity which probably will grow less with improving general business. Encouraging sales of foundry products will extend this advantage to customers who have stood by, during the depression.

What's New in OCTOBER

CASTINGS cast in stellar role. Blend metal makes name in Hollywood productions. Secrets of the studio foundry exposed, (page 12). World's Foundry Congress in Paris, (page 15). Reduced output increases interest in operation of small diameter cupola, (page 17). Legal authority points danger of racket element in damage suits against foundries, (page 23). Manganese bronze technique explained by Charles Vickers, (page 26).

Fig. 1 — Castings are used in many sets. The modernistic stair rail is of cast aluminum

Castings Star as Movie Props

Studio foundryman finds delight in reproducing a wide variety of objects in nonferrous metals

By J. T. JACKMAN

WHILE castings play an important role in the motion picture industry, few foundrymen probably are familiar with the class of work carried on in the studio foundry. To provide a better understanding of some of the difficulties which beset the studio foundryman, it will be necessary to give a brief description of the activities carried on in the mechanical departments of motion picture companies.

A regular order of business, such as is maintained by other large corporations practically does not exist in that industry. True, the companies have their estimators and efficiency experts who do their level best to maintain some semblance of business efficiency, but they, like every one else connected with motion picture industry, are handicapped to a great extent by one thing which is to be found on every studio lot, namely, the temperamental director.

It may be well to cite an example of this so-called temperament. A picture is to be made and the script is turned over to the art director to design the sets to be used. He adheres as near as possible to the descriptions given in the story and designs his sets accordingly. Drawings are

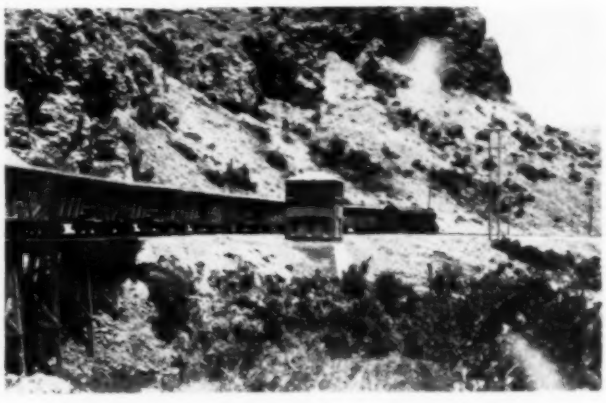


Fig. 2—A miniature box car train which was constructed of aluminum castings

made of each set, the estimator is called in to give his estimates and, if satisfactory, these drawings are turned over to various departments for their part in constructing the sets. One set will require an ornamental grill-work, another will have a balcony and staircase requiring a very ornate railing, and these will be turned over to the department having charge of the foundry to make the patterns and castings and assemble them on the sets designated.

The set is finished and given the official stamp of approval by the art director and production manager and everything is ready to go, when in walks Mr. Temperamental Director and here, if you will pardon the expression, is where the fun begins. Perhaps the stair railing is not elaborate enough or the grill-work is not sufficiently ornamental to suit him. As he is contracted for in advance to direct the picture for a certain specified sum, any changes made to meet with his approval must be made in a hurry if the studio is to stay within the alloted appropriation.

A Week's Work in Two Days

For example, if it took a week to make the patterns and castings for the stair-rail and the starting date is only 2 days from the final completion of the set, it can be seen readily that the studio foundryman will have to work day and night to do a week's work in about 2 days, or less if possible. This is only one example of one picture, but one could see easily what would happen if six or eight pictures, needing the same kind of settings, were to start at the same time and each picture had the same kind of temperamental director. However, all directors are not afflicted with this temperament.

As we go deeper into the activities of the studio foundry, it will be necessary to adhere to the foundry work of the R. K. O. studio where

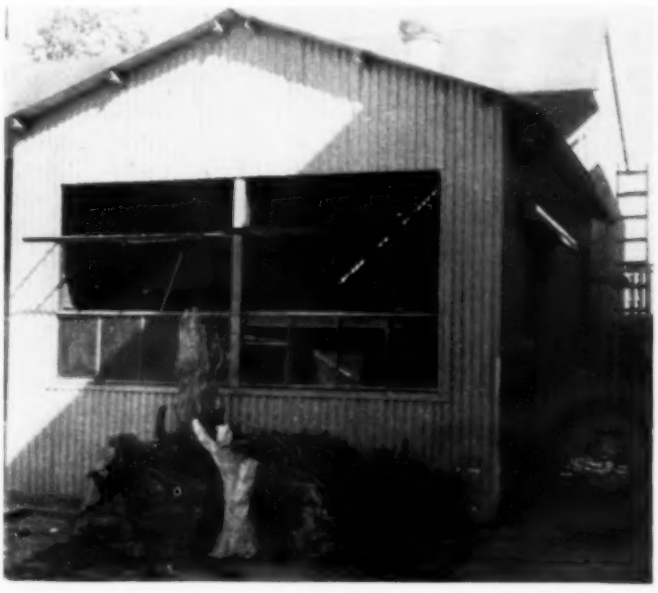


Fig. 3—Exterior of the foundry at the R. K. O. studio

Fig. 4 (Above)—Prop guns of cast aluminum. Fig. 5 (Center)—Cast ornamental trays and book ends used for set dressing. Fig. 6 (Below)—Various types of cast aluminum knives

the author is employed as foundryman. Due to limited space on the lot, it is of necessity a small shop as the accompanying illustrations show. The studio foundry turns out castings of almost every description; castings for cameras, sound effects, ornamental castings, guns, knives, bookends, highly ornate knobs and escutcheon plates for doors, castings for miniature railroad trains, table dishes, in fact even articles of food such as pancakes, oranges, apples, bananas, cookies, doughnuts and rolls. The articles of food generally are cast in aluminum, painted and used for atmosphere and can be used over and over again.

The studio foundry uses nonferrous metals ex-

Fig. 7—Motion picture camera blimp and jack. The camera blimp is made of castings covered with yucca or sponge rubber to make the operation sound proof

clusively. Any iron or steel castings needed are made in outside foundries since none of the studios are equipped to handle that type of work.

Castings for cameras and sound equipment are cast in brass, aluminum, macadamite or No. 20 aluminum alloy, depending upon the use of the casting and strain to be put on it. Castings for props such as guns, knives, dishes etc., are cast of aluminum and painted as nearly as possible to resemble the original.

Some of these props are put to uses that are extremely amusing. For instance, it was found necessary to have some rifles made for a ship scene, and when thrown overboard they would sink immediately. As it would have been an expensive proposition to have purchased real guns merely to throw in the water, it was decided to have some made in the prop shop and the quickest way to do this was to cast them in aluminum. Accordingly, one gun was purchased and brought to the foundryman with instructions to get the aluminum guns out as fast as possible. With the liberal use of wax fillet, the pattern gun, which was a 30-30 carbine, was fixed up so that it could be drawn from the sand easily. A number of them were cast and are now resting somewhere on the bottom of the Pacific Ocean, having already been used in the picture they were intended for.

Something Different Each Day

The studio foundryman has no chance of becoming bored doing the same thing day in and day out, as is sometimes the case in the larger foundries. One day he will be making the finest of camera castings and the next he will be producing prop castings such as lead horse-shoes for movie strong men to twist out of shape, or daggers and bowie knives which, when polished, will shine just as much as a steel blade and are not nearly so expensive nor as dangerous for the actor to use.

There are also certain types of pistols, knives, door hardware etc., that are very rare and cannot be purchased anywhere. To reproduce that type of material, the (*Please turn to page* 46)

Fig. 8—Interior of the R. K. O. foundry where castings are made for a variety of purposes

International Foundrymen's Congress

Association Technique de Fonderie arranges entertainment for visitors from many countries

By VINCENT DELPORT

European Manager, THE FOUNDRY

ON THE site where, in the Middle Ages, students of the University of Paris gathered to follow their lectures, and often give way to various manifestations of youthful enthusiasm, stands the buildings known as La Sorbonne. It is here that degrees in arts, science, law and literature are awarded to those who have followed courses of the university; here also, lectures are delivered to students from all parts of the world.

Choice of the Sorbonne for the official opening of the Fourth International Foundrymen's congress was a happy one, as it surrounded the ceremony with a fitting atmosphere of serious duty, with a background of centuries of tradition. Once again the prestige of the foundry industry has been confirmed and enhanced, not only by the site where the congress was opened, but also by the fact that the French under-secretary of technical education presided in person at the opening.

Many Countries Represented

Official delegations from foundry associations of Belgium, Czecho-Slovakia, Germany, Great Britain, Holland, Italy, Poland, Spain and the United States were present. A. Harley, immediate past-president, Institute of British Foundrymen and president, International Committee of Foundry Technical associations, acted as principal spokesman of the foreign delegations. The American Foundrymen's association was represented officially by R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee.

The congress was organized by the Association Technique de Fonderie under a distinguished patronage, headed by the president of the French Republic and composed of ministers and other high officials. The chairman of the committee of patronage was Ch. Dufour, president of the Syndicat General des Fondeurs de France.

E. V. Ronceray, president of the French association, first addressed the meeting at the opening on Sept. 14. He referred to previous international congresses, in Paris, in 1923; Detroit in 1926; London in 1929. He alluded to the disturbing conditions under which the present congress had been organized. Mr. Ronceray mentioned the fact that the French National Committee of Trade and Industrial Organization had given its active co-operation to organizers of the congress. He concluded by suggesting that the congress should be held under the influence of the analytical mind of Descartes, the persevering character of Richelieu, and the common sense and restraint from exaggerated ideas which characterize the French mind.

Explains Organization Aims

Marcel Bloch, vice president of the French Committee of Trade and Industrial Organization, explained the aims and methods of that committee, which includes 1200 members from industry, the railroads, the banks, and other trade organizations, and which endeavors to reduce waste and production costs, and to rationalize production and distribution. This body of the French industrial world works in co-operation with similar committees organized in other countries, and the work of the various bodies is centralized by the International Institute of Industrial Organization at Geneva.

Mr. Plichon, vice president, Syndicat General des Fondeurs de France, then addressed the meeting and referred to Mr. Ronceray's untiring devotion to the foundry industry, to the association and to the School of Foundry. He was followed by A. Harley, president of the International Committee of Foundry Technical associations, who, in the name of the foreign associations, thanked E. V. Ronceray and his colleagues for the kind welcome they had extended to members of the congress, and for the magnificent program that had been arranged. He expressed his conviction that the efforts of the French association, in their capacity of hosts to the congress, would be successful in promoting the exchange of knowledge and experience, and in contributing to better understanding between

nations. The under-secretary of state then gave the official welcome to the congress in the name of the President of the Republic, and declared the congress open.

Two lectures were then given: one by P. Ageron, Societe des Hauts-Fourneaux de Pont-a-Mousson, on "The Prevention of Accidents in Foundries"; the other by Marcel Bloch, Paris-Orleans railroad, who showed a film illustrating methods of organization employed to supervise and carry out repair work for rolling stock. In the afternoon, the members of the congress visited the international exhibition.

Arrange Social Events

Many social events for the members and their wives were arranged. On Tuesday evening, Sept. 13, the committee of the congress received the members and gave a dance in the building of the Ingenieurs des Arts et Metiers. An inauguration lunch was held at the Hotel Lutetia on Wednesday. On Thursday afternoon the congress was received officially by the City Corporation of Paris at the Hotel de Ville or Town Hall. In the evening there was a dinner and dance at the Eiffel Tower. The official banquet was held on Saturday, at the Hotel du Palais d'Orsay, and on the Sunday the delegates were taken to Versailles, and Rambouillet, the summer residence of the President of the Republic, who personally received the congress.

During the two visits to the exhibition, a number of lectures were delivered at the Stand of the Ecole Superieure de Fonderie, and included the following: "Segregation and Liquation," by Prof. Albert Portevin; "Dilatometric Study of Cast-Irons; Melting Steel in the Cupola," by R. Lemoine, professor, School of Foundry; "New Methods of Rapid Analysis," by Mr. Fournel, professor, School of Foundry; "Lifting Forces in Molds with Cores," by Mr. Pillon, professor, School of Foundry; "Rational Study of the Molding of a Casting," by A. Debar, professor, School of Foundry; "Testing of Sands; the Moisture Test," by Mr. Guillemot, professor, School of Foundry.

A number of works in the vicinity of Paris opened their doors to visitors, including the foundry of the Renault automobile works; the converter steel foundry of Usines de Vitry; the foundry of Ph. Bonvillain and E. Ronceray; Fonderies Lobstein, for high-duty castings; the foundry of the Citroen automobile works; the nonferrous foundry of Compagnie des Compteurs. Many other works and places of interest were visited during the preconvention tours in Normandy and northern France, and during the post-convention tours in the Ardennes and the East, and in the center and south-western France.

Forty-three papers were presented at the three technical sessions. Subjects were divided into groups, and as many as four sessions took place simultaneously in various lecture-rooms of the School of Foundry. In view of the number and the nature of the papers, only a limited number gave rise to discussion. A brief description of each paper or lecture is therefore given with a reference to any salient points that may have arisen in some of the discussions. The full text of the papers is published in the bulletins of the French association for July, August and September, and in two supplements.

"Study of Cast-Irons Made in the Cupola with Low and Very Low Carbon Contents" was contributed by G. Delbart and E. Lecoeuvre. Irons with total carbon ranging from 1.7 to 2.5 per cent were prepared in ordinary cupolas with a fore-hearth. An increasing tendency was found toward hardening for a manganese content exceeding 1.5 per cent. Tendency toward primary hardening can be reduced by acting on the silicon content, except when manganese exceeds 2 per cent. It is possible to obtain irons which can be machined and are at the same time self-hardening, with high mechanical characteristics.

Jean Cournot and Jean Challansonnet discussed "Influence of Molybdenum on Cast-Iron." Additions of the alloy not exceeding 2 per cent increase mechanical properties of ferrite and pearlitic cast-iron by 60 per cent and 40 per cent respectively. Molybdenum retards graphitization in American malleable iron and associated with nickel gives high characteristics for malleable irons after heat-treatment. J. Challansonnet also presented two papers showing influence of titanium and titanium-vanadium on cast-iron.

Oxygen Determination Difficult

"Influence of High Contents of Silicon on the Graphitization of Cast-Irons," was treated by A. Le Thomas and Mr. Olinger. Results of investigations do not quite agree with previous conclusions of Mr. Chevenard, who explained that he had prepared small test-pieces, especially to test the dilatometer, whereas the authors had experimented on a substantially larger scale. Mr. Cournot, A. Le Thomas and Miss Haim presented a paper entitled "Oxygen Inclusions in Cast-Iron." In the discussion it was stated that reduction of carbon in vacuum was the only way to measure oxygen totally. A. Portevin, commenting on lack of agreement on the subject of the paper, said that one cannot be too careful in measurements such as those referred to.

Dr. G. Meyersberg, Berlin, presented the exchange paper of the German association on "Recent Developments in Cast-Irons in Germany." He emphasized how recent methods of investigation and certain new tests derived from previous scientific studies now are applied in the works with beneficial results.

In the section on copper and bronze alloys, Mr. Ballay and A. Le Thomas, in a paper entitled "Cupro-Nickels with Silicon," gave results of recent investi- (*Please turn to page* 58)

Melts Iron in 21-Inch Cupola

Operates small unit commercially to produce from 2500 to 2800 pounds of metal per hour

By GOTTFRID OLSON

Illinois Malleable Iron Co., Chicago

BECAUSE of the present curtailed operating rate of cupolas, capacities of which are out of adjustment with the quiet demand for castings, foundries frequently are encountering difficulty in meeting requirements of customers regarding delivery. To overcome that situation and at the same time produce castings at the lowest possible cost, the author has designed and installed a small 21-inch cupola which provides an operating rate not possible with larger equipment. For example, a foundry operating a 48-inch cupola with a capacity of 9½ tons per hour usually finds it difficult to obtain enough work to pour more than 20 tons a week, or one heat, since a heat of less than two hours duration is not to be considered good economy. To split this tonnage into two heats would amount to a definite loss.

Tuyeres Make Continuous Opening

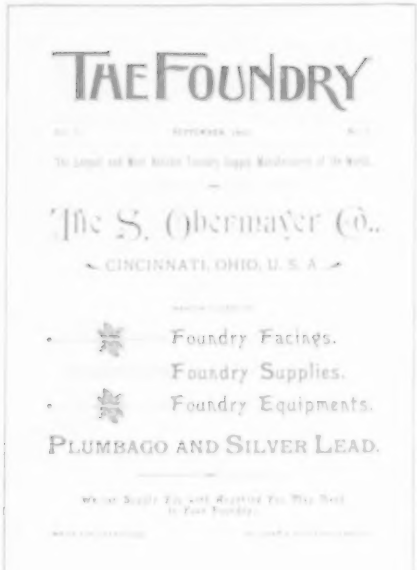
The small cupola, which is simple in design, has been in daily operation for the past 6 months, except on a few occasions when tonnage made it necessary to swing to one of the larger units for a brief period. The shell is 38 inches in diameter, 7 feet in height and made of 3/16-inch steel sheets. It is lined to 21 inches and has two tuyeres on opposite sides. Tuyeres measure 2½ x 14 inches at the shell and flare toward the lining, making a continuous opening.

A sheet iron pipe, 21 inches in diameter, leading through the roof with an attached hood, 42 inches in diameter, is suspended 4 feet from the top of the cupola. A single drop door is provided, supported on one prop. The tuyeres are set 9 inches from the sand bottom, and a slag hole is placed 1-inch below the tuyeres. This hole is left open and slag is drawn off before every tap. Peep holes also are provided. A fan delivers air under 3½-ounce pressure, being driven by a 4-horsepower motor. The melting rate is 2500 to 2800 pounds per hour, depending upon the materials charged. Castings weighing up to 1000 pounds have been poured.

Charges are made up in steel pans and stored on a platform 42-inches high. From this platform, a stepper, 3-feet high, facing the cupola serves to bring the operator high enough to enable him to place the material in the cupola. A skip hoist may be installed at a small cost.

The cupola is lighted with wood in the regular way and allowed to burn 1½ hours before charging is started, the coke bed being held at 24 inches above the tuyeres. The charge consists of 300 pounds of iron, 30 pounds of coke and 10 pounds of limestone. The latter is placed on top of the coke. (*Please turn to page* 56)

Side view of the cupola showing method of charging, slag hole, spout and one tuyere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Through the Years With THE FOUNDRY

Cover from the first issue of The Foundry reproduced in miniature as it appeared in September, 1892

WHAT was the big news in the foundry industry in the closing years of the Nineteenth Century when THE FOUNDRY was presenting the first complete report of important events in the manufacture of castings? The pages of those early issues of the rapidly growing journalistic youngster pass in review an intensely interesting chain of events, unusually dramatic in conception and execution. Romance, the romance of metals; love, the love which is exemplified in service to the industry; tragedy, the tragedy of adversity; all are ever present as the industrial struggle is pictured in the records of successes and failures of that generation. Individuals occupy the spotlight for a time, often all too brief, and then the mantle of leadership is passed on. A comparison with the industrial situation as it exists in 1932, 40 years after the establishment of THE FOUNDRY, accentuates the fact that history again is repeating itself.

Speeding Castings Production

New developments in machines to assist in castings production, and a growing realization of the important role various types of machines would assume in future foundry operations probably constituted the leading news feature of 1892. An exhaust tumbling barrel having 2-inch, well-seasoned, oak-timber staves, lined with steel plates; a money saving machine which recovered shot and scale iron from foundry refuse; an iron carrier operating on an overhead rail to provide "rapid transit" of iron from cupola to mold; a new adjustable snap flask, and a taper wood flask were among the innovations.

The struggle between hand labor and the machine was drawing to a close, with a victory for the machine. S. Boland, writing in November, 1892, said: "The molding machine is here to stay, no matter how much opposition is brought to bear against it. On the whole, I cannot see why there should have been such wide spread opposition to its more general reception. Other trades have proved how utterly impossible it it is to stem the tide of modern improvements in labor saving machinery. It therefore behooves us to accept the inevitable and gracefully welcome the iron man as one of the fraternity."

Advertises Properties of Semisteel

In the same year, the South Chicago Foundry Co., South Chicago, Ill., became one of the numerous foundries producing semisteel, a metal "with more than double the strength of the best gray iron." The semisteel was reported to have a tensile strength of 36,000 pounds per square inch, was sound, homogeneous and remarkably free from blow holes. Pig iron of the No. 2 Southern grade was selling for $12.25 to $12.75, as compared with $11.00 for the same grade in September, 1932.

In 1893, news of Worlds Fair in Chicago overshadowed all else. THE FOUNDRY, in commenting on the event, regarded it "a magnificent, a stupendous success," and advised its readers to go. Many fine specimens of the castings art were on display and several manufacturers of equipment were represented at the exhibition. Interesting features included the oldest stove in America, which was made in France in 1693 and at the time of exhibition was valued at $10,000; a model of the Roman process for casting cannon, a remarkable collection of Russian castings, much of which now is on display in THE FOUNDRY office, and the first iron casting made in America, a small cast iron kettle now in possession of the city of Lynn, Mass.

The association movement was beginning to spread during that year. The Foundrymen's association of Philadelphia, although in existence a relatively short time, was reported as accomplishing much good. Chattanooga foundrymen

formed an association on March 4, and on May 25, the Western Foundrymen's association was established "to promote the interests of all connected with the great foundry industry of America, and especially that territory known as the Western States." The editor of THE FOUNDRY was made a member of the executive committee.

Financial System Troubled

But a shadow seemed to be cast over industry. In July THE FOUNDRY pointed out "that for the past 60 days or so it has been apparent that there is something seriously wrong with the financial system of the country." The editorial stated that fear and distrust had gripped the minds of all classes of people. August brought the following comment: "Again we say that we have the greatest country, the most energetic, ambitious and intelligent people and that we are always going to have the greatest measure of prosperity." An upturn was expected momentarily, but as in the grim days of 1930 and 1931, improvement failed to materialize. The depression was on, bad times were a grim reality.

Badge given to those attending the first A. F. A. convention

Outstanding developments in equipment were lacking in 1894. Unrest brought about by the business situation was crystalized in the Pullman strike. The coal strike resulted in a shortage of coke and great railroad disturbances limited the amount of castings demand from that source. By September, THE FOUNDRY reported the business situation on the mend, and the close of the year brought the following comment: "Business is getting better, no question about it, and although this is not the season for the foundrymen's harvest, yet a large number of them are fairly busy."

Abatement of the storm continued with the new year. In March of 1895, THE FOUNDRY proclaimed the thought of business leaders as follows: "The country is saved. Congress has adjourned. European gold is again finding its way across the continent and confidence is being restored—to those who have not had it right along." The improvement was amplified further by the number of new foundries built and the large list of plants which were enlarged; a total far exceeding any of the previous 18 months. Aluminum was gaining in both popularity and application, and more shops were built to cast that metal.

Once released from the oppressing influence of the business situation, foundrymen again manifested interest in group activities and association meetings flourished. Members discussed the application of equipment to foundry problems, especially those of handling, and one speaker pointed out that conveyors could be arranged to carry the molding sand overhead where it would be within easy reach of the molder. Then as now, foundry costs was a lively topic of conversation at any gathering, and a speaker on "Costs and Cost Sheets" before the Western Foundrymen's association stressed the need for a standard cost system for foundries.

Publication in the pages of THE FOUNDRY of exceedingly complete reports of various important meetings of foundrymen unknowingly was creating an industry consciousness, a state of mind that distinguishes the foundry industry today. Need for a joint effort in furthering the fortunes of the industry first developed in Philadelphia, when the executive committee of that association "proposed to hold a national association of foundrymen under the auspices of that association" and extended an invitation to the Western Foundrymen's association to co-operate in issuing a call for the meeting. The call was issued by the Philadelphia group for Nov. 20, 21 and 22, 1895, but due to conflicting meetings, was postponed until the following year.

January and February again found business on the decline, and later events proved this the start of the second phase of the depression. But associations continued to be born, and on Feb. 11, foundrymen of the northeast formed the New England Foundrymen's association and listened to a paper by John A. Penton, editor of THE FOUNDRY, on the work already done by various associations. Whether or not it may be attributed to the influence of association discussions, is a question, but a new technical trend was evident in some of THE FOUNDRY's presentations. For example, an article given prominence in the March, 1896, issue was entitled "The Mobility of Molecules of Cast Iron."

Of Great Benefit to All

The biggest news of the year to the foundry world now was in the making. Forces were at work to bring about an event destined to perform a service of inestimable value to the industry for many years to follow. In March, an invitation for a national meeting of foundrymen was issued by the Philadelphia Foundrymen's association, seconded by the Western Foundymen's association, and sent to a list of companies and individuals supplied by THE FOUNDRY. May 12, 13 and 14 were the dates selected, with Philadelphia the meeting place. In its first announcement, THE FOUNDRY said "It is expected that the city of Brotherly Love shall be again the birthplace of a national movement that will be of great benefit."

Conservatism in (*Please turn to page* 54)

Economies in Steel Casting Design

Co-operation between designer and foundryman is necessary to perform functions of design

By F. A. LORENZ JR.
American Steel Foundries

STEEL castings lend themselves with great facility to the varied necessities of design. The wide range of their application in industry indicates the dependence placed upon them. This range grows greater as the designer and the foundryman reach a better understanding of their related problems and as the objectives of the one are conditioned to meet the facilities and technique of the other.

It is not necessary that the foundryman be qualified as a designer, nor that the engineer be versed thoroughly in foundry practice. The common ground of their interest is the most economical production of a casting which embodies the desired characteristics of utility and appearance. Economic considerations justify whole-hearted co-operation that penalties of high production costs and impaired soundness may be avoided.

There is a tendency among foundrymen to devote their energies to production of designs as submitted, without bringing to the attention of engineers features which impose high production costs. This failure leaves the designer ignorant of economies which could be effected. Occasionally, when the designer is prompted by economic reasons to resort to a fabricated or forged substitute, he finds that radical changes in construction are involved, to accommodate limitations of the manufacturing process selected. It is quite possible, that, had the foundryman presented his requirements for economical production, suitable alterations in the design would have been made. It is also possible that the designer would have been able to retain desirable features which he was forced to sacrifice in the substitute.

To the designing engineer belongs the initiative in bringing about co-operation between himself and the foundryman. Originating in his

Fig. 1—Two views of original design which involved the use of complicated cores in molding

Fig. 2—The redesigned casting which permits the pattern to leave its own core when withdrawn

mind, the design is developed and ultimately presented to the foundryman for his quotation of price. Too frequently the design is developed with no great consideration of changes which might reduce the cost of production or of modifications which would improve the ability of the casting to withstand the stresses imposed in service. These are important considerations, and much benefit may be gained if the broad fundamentals of steel founding are understood by the engineer, or if he will avail himself of information which a steel foundryman can give.

Fig. 5—Two views of a casting showing methods employed in producing a more uniform rate of cooling

It may not be an exaggeration to state that it is as essential in developing a design to understand the characteristics and behavior of steel in the mold as to know its characteristics and behavior under working conditions. The stresses set up in cooling, the starvation of obscure sections, the influence of one section upon another, and the numerous factors entering into production of steel castings bear strongly upon cost and ability of the casting to meet conditions of service to which it will be put when completed.

Temperature at which steel for castings is tapped from the furnace is usually in excess of 2800 degrees Fahr., the nature of the castings to be poured regulating requirements of temperature. Castings of heavy section may be poured with metal of lower temperature than can those of light section, requiring very fluid metal.

Although the loss of heat begins immediately upon tapping the metal from the furnace, the most drastic drop occurs at the instant of contact of the metal with the surfaces of the mold cavity. The chilling effect of this contact causes the instantaneous formation of a skin of solidified metal. The casting for a short period consists of a shell, the interior of which is filled with fluid metal. Fig. 6 shows a section of a simple block which was bled by breaking an opening 15 seconds after pouring was complete. This illustrates the rapidity with which the shell of solidified metal is formed.

Fig. 3—Sweeping curves used to avoid radical changes in the direction of the contour

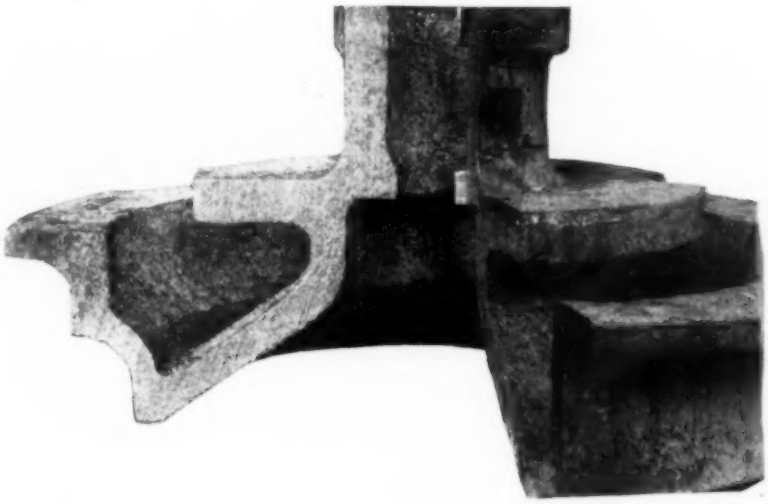
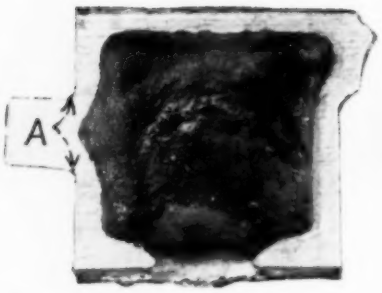


Fig. 4—Cut away section of a cylinder head casting showing properly proportioned sections

Steel, as it solidifies, forms crystals, and the shell created by contact with the mold surfaces is of crystalline structure increasing in thickness as the temperature of the interior, due to loss of heat through the shell, reaches a point where additional crystals are formed upon its inner surface.

This formation of crystals also involves a contraction as the change from the liquid to the solid state takes place. Action of formation of crystals is progressive and takes place from all directions toward the center. That area, being the last to solidify, continues to supply the demands for material until it is exhausted. In the absence of a source from which it, in turn, may draw needed material, the demand goes unsatisfied and a shrinkage cavity results. Fig. 7 shows a section through a block which was allowed to solidify with no provision for supplying the material needed to compensate for shrinkage.

This necessity for adequate feeding



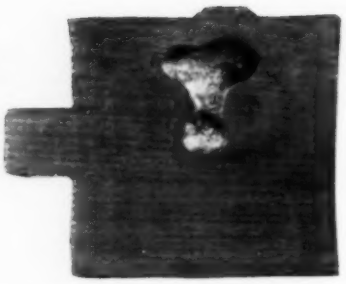


Fig. 6 (Left)—Casting shell formed by bleeding 15 seconds after pouring. Fig. 7—(Right)—Section showing shrinkage cavity

should always receive the serious attention of the engineer. If it is not possible to incorporate uniformity of section in the design, location of heavy sections should be such that they may be supplied readily with material from conveniently located risers, or be fed through an adjacent section of sufficient bulk. In general, sections located in the lower parts of the mold draw material from those sections immediately above them. These are, in turn, fed from the surplus provided in the superimposed risers. Invaluable assistance can be rendered in production of sound castings if, in designing, the sections are arranged to facilitate proper feeding.

Sections Influence Soundness

Fig. 9 indicates the manner in which the locations of sections, in relation to others, influence the ultimate soundness of a casting. The casting is represented by sections A_1-A_2, B-B_1, C-C_2, and the risers by A and C. In cooling, A_2 is fed by A_1, which, in turn, receives material from riser A. Sections B and B_1 due to their lightness, cool almost instantaneously and require little feeding. Such material as is needed is supplied by the adjacent sections. The location of heavy section C_2, below the lighter section C_1, effectively shuts off its supply of material. The provision of excess metal in riser C is ineffective, because C_1 is lighter than C_2, and solidifies before the latter. The result is the shrinkage cavity at D.

A comparison of the rapid, almost instantaneous solidification of thin sections, with the slower, progressive freezing of heavy sections, indicates that the capacity of surrounding sand for carrying away heat is limited. This also is shown by the boss on the bled casting in Fig. 6, which has progressed much further in its solidification during the same time interval, than has the block proper. The surface area of the boss is greater, in proportion to its mass, than that of the body of the block. Its proportion of radiating surfaces to the volume of heat in its mass permitted rapid cooling.

Fig. 6 shows, in addition to what has been mentioned, the effect produced by connecting members. The sand which formed the sharp corner at the junction A, of the boss with the block, was called upon to transmit heat from the surface of the boss, as well as from the surface of the block. The double duty imposed upon this area was greater than its capacity, and the lag in transmission is evidenced by the thinness of the skin at the juncture. Though the time interval was but 15 seconds, the effect of retardation is quite evident.

The same tendency exists at junctures of all sections and is likely to be evidenced in the form of a shrink unless proper precautions are taken to reduce abruptness of the union. The simple expedient of providing suitable radii at such points serves to increase the area of radiating surfaces, and provides for an approximately uniform cooling rate throughout. This method is shown in Fig. 10. The introduction of properly proportioned fillets, by eliminating sharp corner of sand, provides surfaces capable of more rapid heat transmission than otherwise could be effected.

There are occasions when such a junction, because of the size of the sections, creates a mass of such size as to require the use of risers to insure solidity. Such a condition, and incidental difficulties tending to cause shrinkage cracks, often may be avoided by staggering the sections, as shown in Fig. 10. Cross-ribs, the functions of which are largely those of reinforcement, particularly lend themselves to this form of relief.

Fig. 8 illustrates an expedient adopted to reduce the concentration of heat at the junction of the cross-ribbing and the body of the casting. Normally, risers would be required at these points to insure solidity. Instead, relief cores, A, were placed to provide the openings shown, thereby reducing the mass at the point of heat concentration, and (*Please turn to page* 48)

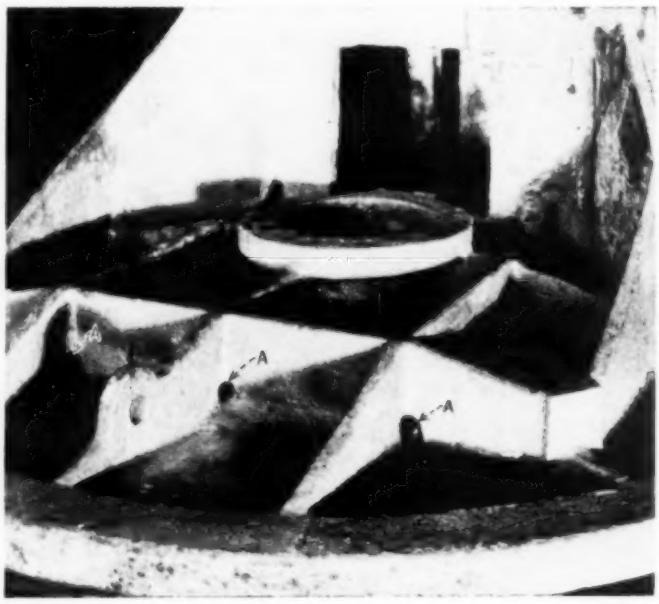


Fig. 8—Holes used to reduce concentration of heat at junction of cross ribbing and body of the casting

Do Lawsuits Levy Tribute?

Legal expert points to dangers of common law damage cases based on alleged silicosis

CONSIDERATION of health hazards induced by dust which is encountered in various industries has had marked attention in the past few years. Progress in understanding and applying principles of ventilation and the use of specially designed protective devices undoubtedly have shown marked progress in many lines of manufacture. The foundry industry is familiar with the hazards incident to the production of castings and has made long strides in alleviating unhealthful conditions.

However, this has not prevented the foundry industry in common with many others, from being victimized by certain unscrupulous interests that have based suits for compensation upon the ignorance and apathy of juries when awarding other peoples' money.

Presents Valuable Observations

The various pulmonary diseases arising from dust conditions are myriad. These include *asbestiosis*, arising from asbestos dust; *anthracosis*, from coal dust; *siderosis*, from iron particles; and *chalcosis*, from fine particles of copper. All of these are grouped by medical authorities under the term *pneumonoconiosis* which literally means, dusted lung. The consideration of these diseases, of course, is within the province of the medical fraternity.

The legal aspects of these hazards and particularly those relating to silicosis, accredited to breathing fine particles of silica, of course, are of prime interest to foundries. In an article covering the legal aspects of the silicosis subject, appearing in *Industrial Medicine* for October, Andrew J. Farrell has some observations that will be of interest and value to the foundry industry. Mr. Farrell, who was graduated from Northwestern University Law school, is in charge of the claim and legal department of the Central West Casualty Co., Chicago, where his duties have brought him into intimate contact with the questions upon which he writes. Mr. Farrell says that many suits now are in process or pending, based upon claims that workmen have incurred silicosis during their employment in some industry where silica dust may be encountered. In the state of Illinois alone, he says that approximatey 200 such cases are pending in common law courts, many probably due to the activity of ambulance chasers. Mr. Farrell's observations on the subject follow:

"Silicosis suits are divided into two classes according to the different state laws. The first class are under the workmen's compensation acts of several states—California, Connecticut, Massachusetts, North Dakota, Wisconsin, and the District of Columbia. The second will be referred to as common law cases, the right to sue being created either by common law or a statute. In those states where silicosis and kindred sicknesses are controlled by the workmen's compensation act there is not so much activity in stirring up claims, as the amount to be recovered is limited by the statutes. Under practically all workmen's compensation acts the payments are made in weekly installments, and the rights of the claimant are still subservient to the powers of the industrial commission, even after trial. In other words, if an award is erroneous as to the extent of disability, the respondents or defendants can file petitions to have the same corrected by offering additional evidence and proof of the physical condition of the claimant.

Racket for Ambulance Chasers

In the common law courts, however, there is no limitation as to the amount to be recovered except in a few states where there is a statutory limit on recoveries for death. The judgment in a lump sum is final after the defendant has appealed to the court of last resort, and it is usually paid in a lump sum. After the judgment becomes final it is impossible in practically all jurisdictions to change it as to amount, even though newly discovered evidence indicates that the condition of the plaintiff was exaggerated at the trial. As the fees of ambulance chasers range from one-third to one-half of the sums recovered, it can readily be seen that it is a racket which appeals to chasers, unscrupulous lawyers and doctors who put the dollar ahead of the ethics of their profession.

In various industrial centers ambulance chasers have representatives. The latter may be a local storekeeper or a small business man

who has connections with the workers in the various plants. The steady, consistent worker is not ordinarily prey for the chaser; it is usually the worker who has been discharged for inefficiency who is ready to sign a contract because he, in his own mind, is gong to be benefited in at least two ways. First, his enmity toward his superior is appeased. Second, there is an opportunity to make a little easy money without working for it. Usually, when a case of this nature is tried it is necessary for the plaintiff to produce as witnesses fellow employes to prove the conditions in the plant or factory. If the litigation is successful, the witnesses become plaintiffs in their own rights and the others act as their witnesses, and so it goes.

Ordinarily when a worker or former worker steps into the headquarters to sign up, he is informed that they cannot tell whether he has silicosis or not but they are willing to defray his expenses to an adjoining city where there is a special silicosis "clinic." The train fare is advanced and the subject leaves for the "clinic" where he is greeted by an "eminent" specialist. His history is recorded, a clinical examination is made, x-rays are taken of his chest, and after much deliberation he is called into the office of the specialist and informed that he has silicosis either in the ante-primary, the primary, or the secondary stage, but that he should not be overly alarmed. The contract is signed shortly thereafter. The supposed "clinic" is operated by a doctor who specializes in testifying in court as an expert on almost any phase of medicine or surgery. A night with the authorities on any particular phase of medicine or surgery is enough to provide sufficient ideas for such gentlemen to qualify. After the contract is signed the man goes back home and awaits developments. He goes back, however, with all the symptoms of silicosis, skillfully made a part of him by suggestions on the part of the doctor. In many states it is possible to start what is known as a "poor person's" suit, without the payment of a filing fee. This is accomplished by the execution of an affidavit of poverty by the plaintiff. The doctor will take a gamble on the judgment to be obtained, for his fee. Hence the only expenditure is for railroad fare, and that is advanced.

Activities Would Fill Book

The activities of the ambulance chasers in these cases would fill a book, but further comment on the details will only serve to divert from the theme. In leaving this subject it might be mentioned that there is considerably activity in some of the coal fields in various parts of the country at this time, and if something is not done to control this situation by legislation, the ramifications of this new "racket" will be far-reaching, and add another load on our already taxed and overburdened industries.

There is rarely a defense in a court of law to a well prepared silicosis case regardless of whether the plaintiff has silicosis or not. This statement may be astounding to the reader, but a little explanation will be conclusive of its truth. It is always a question of fact for a jury as to whether or not the plaintiff has silicosis and whether or not it resulted from conditions in the plant or factory in which he was working. Where does the jury get the facts? From the witnesses. And where do the witnesses come from? The plaintiff produces witnesses to prove his contentions and theories and the defendant produces witnesses to negative the testimony of the plaintiff's witnesses or to establish the contrary facts. Included in the witnesses for the plaintiff will be a doctor or doctors who will testify that from a clinical and x-ray examination they are of the opinion that the plaintiff has silicosis and further that it resulted from working conditions in the defendant's plant or factory. The working conditions are described by the plaintiff and four or five of his fellow workers. If it isn't silicosis, it is tuberculosis superinduced by silicosis, or tuberculosis aggravated by silicosis.

Appeal to Jury Sympathy

Exhibit "A," the plaintiff himself, if he has a sickly appearance, has more influence on the sympathetic jurors than have all the medical experts from here to the North Pole. Incidentally, the kindly souls of jurors are so stirred up by the tales of expert witnesses with their mysterious phrases, x-rays and general display that the case is magnified in importance to such an extent that the jurors become very generous with the defendant's money and go home satisfied that they have done their little deed for humanity, completely oblivious to the part they are contributing to the burden on industry. This is exemplified by verdicts in silicosis cases ranging from $10,000 to $50,000.

The most capable, persuasive defense trial lawyer in the country cannot stop the onslaught of a heavy verdict when the facts are fully presented by a clever, cunning lawyer for the plaintiff, and in most of the bad cases such a lawyer will appear—as the ambulance chasing lawyer is smart enough to call in as his associate to try his case, the most appealing jury lawyer that is agreeable to try the matter. The foregoing is only a part of the ramifications of silicosis claims. It would take several volumes to cover the situation fully, which is not necessary here, the main purpose of this article being to make the danger of the situation apparent to those interested.

Industry is concerned with the arrest and prevention of silicosis. Industry is also interested in preventing fraudulent silicosis claims and in the control of the situation so that compensation for such a condition is fair and not unduly excessive as it now is where the remedy is at common law. The arrest and (*Please turn to page* 56)

Where Is Industry Headed?

Steel Founders society president at recent meeting stresses need for straight thinking

By ARTHUR SIMONSON

Falk Corp., Milwaukee

FEW things in life are unmixed blessing, and conversely, few things are an unmixed curse. From the stress and strain of the more or less late readjustment, we should have learned many lessons of thrift, efficiency, straight thinking and the necessity of returning to some of the first principles instilled during school days. There never should be a return to the careless, happy-go-lucky days of what seems to be long ago but in reality is but a short time.

Opportunity to Learn

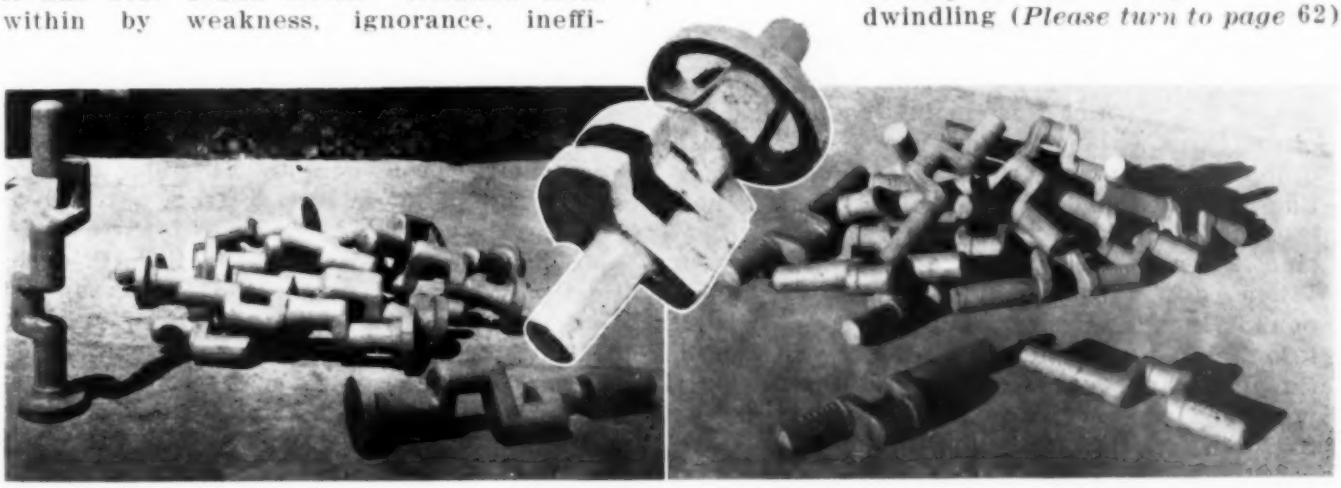
Industry has had an opportunity to learn much of management, foresight, conservation of resources, salesmanship and many other things. We should have learned these things, but have we? Depend upon it, we shall wait sometime to see again the days we have seen, and thought were permanent.

The great question that is agitating the minds of the membership of the Steel Founders society, and also those who are not members, is—Where is the steel foundry industry headed? I think it is obvious that this fundamental industry is today in the most precarious condition in which it has ever found itself. Assailed from within by weakness, ignorance, inefficiency, and from without by the direct attack of competition of other industries, we are practically against the ropes and gasping for breath.

The price obtained for castings has declined to a point where it not only represents a terrific loss, under present conditions of operation but makes profit impossible if operating at full capacity. This is the result of unsound thinking, of a lack of knowledge of normal costs, of poor salesmanship, and a desire to get more than a fair share of the going business. How often does it have to be reiterated that no man ever bought a steel casting to satisfy a desire to own one; that the price will never increase the amount of available business and that the honest buyer is willing to pay a fair price. How long must it be shouted from the house tops that the only prices that will insure the continuity in existence of our establishments are those which are made up of actual cost plus a profit? These principles have been pounded into our ears for so long that they seem to be no longer effective or we have grown deaf to the truth.

Standing at the Crossroads

There is no doubt that we are standing at the crossroads, on the one hand leading to good business at a profit and on the other to bankruptcy and disaster. The decision is in our hands. Membership of the society has been dwindling (*Please turn to page* 62)



A steel casting never is produced until ordered and therefore should be priced on the basis of cost of production when ordered

Experiments indicated aluminum strengthened the alloys greatly

Making Manganese Bronze

Early investigations indicate importance of hardening alloy for consistent results

By CHARLES VICKERS

BEFORE the advent of manganese bronze, no strong casting alloys of copper began to meet modern requirements. The world was awaiting the coming of a Deville and a Hall to provide aluminum, for until that element was produced, strong alloys, as we now know them, were not made.

Much work had been done by various investigators on what were known as strong bronzes; the maximum bronzes, as Thurston named them, which were mainly copper and zinc alloys carrying small amounts of tin, or of iron, or both. For example, sterrometal had a similar composition to some of the manganese bronzes; one alloy being copper 56½ per cent, zinc 39 per cent, iron 3 per cent, tin 1½ per cent. When cast in sand molds it had over 40,000 pounds tensile strength, but its elongation was less than 0.5 per cent. Tobin's alloy was one of the maximum bronzes, its composition being copper 58.22 per cent, zinc 39.48 per cent and tin 2.30 per cent. That alloy still is used, but when cast in sand it is advisable to add a little aluminum.

Any alloy of copper and zinc containing in excess of 30 per cent zinc, cannot be cast in sand molds without the addition of aluminum or silicon. Either can be used, and both have a similar action in conferring fluidity on the metal when it flows into sand molds. At first it was thought that providing fluidity was its only function, but further study and experimentation, showed that aluminum also strengthens the alloys greatly.

Employed Ferromanganese

Manganese bronze first was patented in England by Parsons in 1876, and 2 years later in the United States. The first alloys were considerably different from what now is regarded as manganese bronze, being copper-tin alloys containing about 10 per cent tin and from 0.5 to 1.5 per cent ferromanganese having from 5 to 20 per cent of manganese. As much as 5 per cent ferromanganese also was used in alloys of copper and zinc. It was specified the ferromanganese should contain as little silicon as possible.

In making the alloy, molten ferromanganese was poured from a plumbago crucible into another crucible filled with molten copper and the mixing of the two was affected by stirring with an iron rod. Tin and zinc or both were added in the proportions required to make the alloy, and after further stirring and skimming the

bronze was poured into molds. No aluminum was added to the first alloys devised and it was not until 10 years after the issuance of the United States patent that the value of the aluminum in the bronze was realized, and then only to the extent that it improved the casting qualities of the copper-zinc alloys, which from that time on rapidly displaced the manganese bronze containing tin.

For many years manganese bronze was made with a hardener which was supposed to confer strength and ductility to the alloy of copper and zinc. This hardener, known as *steel alloy,* was imported from England as an alloy of 62 per cent iron, 32 per cent tin and 6 per cent manganese, by William Cramp & Sons Ship & Engine Building Co., Philadelphia.

Cramps manganese bronze, as it was known, was made as follows, according to the late E. S. Sperry: Ingot copper, 56 pounds; Bertha zinc, 43 pounds; *steel alloy,* 2 pounds; aluminum, ½ pound. This seems simple enough to make, but the joker in the formula lay in the steel alloy. Its melting point was too high for yellow brass and copper. It would not have been too high for copper had the metals in the steel alloy been soluble freely in copper, as, for example, with nickel instead of iron as the base of the steel alloy. It was necessary to superheat the copper strongly before it would dissolve the hardener.

Steel Alloy Not Criticized

Even if properly superheated, the steel alloy might not be kept submerged until dissolved and the steel alloy would be oxidized wholly or in part. Then it was impossible to dissolve it, and the bronze, when cast, was little better than a yellow brass. In those years it never occurred to anyone to criticize the steel alloy to discover if its composition was reasonable. The main idea was that iron conferred strength, and the manganese *carried* the iron into the alloy, for it was well known that it was difficult to alloy copper and iron. The tin addition was supposed to be necessary as the maximum bronzes previously mentioned all contained tin, zinc and copper in approximately the proportions of 58 to 54 per cent copper; ½ to 2½ per cent tin, and 44 to 40 per cent zinc. Within that range came sterrometal, muntzmetal, tobin bronze, etc., but for foundry purposes none of those alloys was successful because it could not be cast in the absence of either aluminum or silicon.

Aluminum most generally used for its fluxing action in the 60-40 copper-zinc type of alloys, especially when leaded, causes heaviest shrinkage. When 60-40 alloy free of lead is troubled with shrinkage, 1 per cent silicon-copper containing 10 per cent silicon should be substituted for aluminum and shrinkage will disappear. However, a 60-40 copper-zinc alloy containing lead, silicon is inadmissable, because lead silicate will be formed, and the castings will be filled with a gray dross which spoils them. By remelting the silicon-copper containing 10 per cent silicon and adding 5 per cent aluminum, lead silicate is not produced and the alloy of silicon and aluminum which is formed can be used for fluxing the high zinc alloys, making perfectly clean castings, free from shrinkage.

This alloy sometimes is used in making manganese bronze, and when produced in that manner, the bronze has comparatively little shrinkage. However, a manganese bronze depending entirely upon silicon for its fluidity, will fall several thousand pounds per square inch under the tensile strength of an alloy in which aluminum has been used. The gain in the small amount of shrinkage is offset in loss of tensile strength and elongation. Of course, the consideration of strength does not appear at all in the case of zinc alloys used for such castings as those of plumbers ferrules.

Claimed Iron Was Detriment

About 12 years ago the author undertook to discover a better way of making manganese bronze, which still would conform to specifications of Parsons' or Cramp's alloy. In the first place the steel alloy came under close scrutiny. It was granted that its melting point was high, but more important was the fact that its solubility in copper was too low, and solubility of ferromanganese also was low. As a consequence it appeared futile to expect manganese to cause iron to become more soluble in copper. In fact Alfred H. Cowles claimed that iron was a detriment to manganese bronze. He made many tests and got uniformly higher results and elastic limits without iron and stated that manganese bronze was an evolution from Thurston's maximum tin-copper-zinc alloy. Manganese bronze marketed in the '80's by Parsons and Dick contained iron as a constituent because at that time the only cheap way of securing manganese, as Cowles was told by Alexander Dick, was to melt copper under a layer of molten ferromanganese. Copper took up a certain percentage of both iron and manganese.

Cowles made manganese-copper in the electric furnace at Lockport, N. Y., using pure manganese oxide as the source of manganese. The manganese copper so made practically was free from iron and was found to give better results. However, analysis of Parsons manganese bronze had to be adhered to closely enough to conform to specifications drawn up by the government and large manufacturers, otherwise there would be more or less difficulty in selling the alloy.

At that time the steel alloy being used consisted of tin 31.25 per cent, iron 66.25 per cent, manganese 2.50 per cent. Results were fair and usually castings met physical tests demanded. Occasionally the foundry had nothing to boast about, and in one case (*Please turn to page* 46)

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, Charles Vickers.

Special Heat Treatment Increases Malleable Strength

On different occasions several customers have asked for malleable castings with greater tensile strength, yield point, and hardness than standard specifications. They specify castings having 75,000 pounds per square inch tensile strength; 37,000 pounds per square inch yield point, and about 180 brinell hardness number. We have been forced to pass up the order. We now find that another foundry filled the order with castings that had been subjected to a special heat treatment process. As we understand it, the process is to prevent embrittlement in castings to be galvanized, and would not give the results required. We would like to know whether a heat treatment process will increase the tensile strength, yield point, and hardness in castings that will not be subjected to galvanizing. Two bars poured from the same ladle and annealed in the same pot gave the following figures: Special heat treatment—49,200 pounds per square inch yield point; 57,200 pounds per square inch tensile; 9.5 per cent elongation, and 8.0 per cent reduction of area. The regular treatment showed 37,400 pounds per square inch yield point; 50,700 pounds per square inch tensile; 11.0 per cent elongation, and 12.0 per cent reduction in area. The analysis was 0.75 per cent silicon; 0.067 per cent sulphur; 0.26 per cent manganese, and 2.62 per cent total carbon. From the analysis we expected a greater elongation.

Special heat treatment process mentioned does strengthen and harden the metal to some extent, but results reported seem to show a somewhat greater effect than expected. Results to be expected may vary from 600 to 3000 pounds per square inch in tensile strength. From analysis given, you hardly can expect a higher elongation than that obtained. The special process mentioned will not give malleable iron with a tensile strength of 75,000 pounds per square inch, or anywhere near that figure. However, a somewhat similar process recently developed is said to develop tensile strength around that value. Both processes are patented.

Air Furnace White Iron Used To Make Grinding Balls

Is air furnace malleable white iron suitable to cast into balls for pulverizing nonferrous ores?

Balls for pulverizing nonferrous ores are made according to three different processes. Adoption of castings made by one process in preference to those made by either of the other two, depends principally on local conditions and on cost of castings at point of delivery. Thus one prominent western consumer with a pile of scrap steel on his hands, developed a method for casting these balls from an all scrap steel charge melted in an electric furnace and poured into chill molds. At another prominent plant all scrap steel charges are melted in the cupola and the resulting metal is poured into chill molds. Several western foundries specialize in production of hard iron balls cast in sand molds. White iron melted in the air furnace and cast either in sand or chill molds is quite satisfactory for the purpose outlined.

Copper Improves Rust Resistance of Steel Castings

We operate a steel foundry in England and we would like to know if the addition of 0.5 per cent copper as practiced in Germany materially reduces the corrosion of steel castings. Is there a cheap element that can be added and used commercially to reduce corrosion? Is there a method of coating other than galvanizing to resist oxidation at atmospheric temperatures, and which may possess advantages for steel over galvanizing?

Undoubtedly the addition of a small percentage of copper to low-carbon cast steel will increase its resistance to atmospheric corrosion to approximately the same extent that it improves the rust resisting properties of steel sheets. However, that is far from saying that a copper-bearing steel will be rust resisting. Copper-bearing roofing sheets rust more slowly than noncopper

bearing material, but to get a good life from the sheets they have to be galvanized. We do not know of any cheap element which can be added to steel to make it rust-proof.

In addition to the hot dip and electrolytic galvanizing, there is the sherardizing process for coating metal articles with zinc. In that process the articles are packed in pots filled with zinc powder, and are heated to an appropriate temperature which is considerably below red heat. The sherardized coating looks something like a galvanized coating, only that it is dull rather than bright.

Alloy for Bearings Contains Zinc and Aluminum

> Can you give me information on the best method of making a high zinc bearing metal containing 86 per cent zinc, 10 per cent copper, and 4 per cent aluminum?

This alloy we understand is a proprietary composition, made by first melting the zinc, but not allowing it to flare strongly, and then adding copper in sheet form as rapidly as the molten zinc will take it up. Aluminum is added after the copper is dissolved. In this method it is advisable to reserve some of the zinc for cooling the melt after the copper and aluminum have been dissolved, as the alloy is likely to flare strongly. It may require a little experimental work to determine the right amount of zinc to reserve, but if too much is held back, it is not difficult to raise the temperature.

Another method of making it is to make an alloy of 50 per cent copper and 50 per cent zinc, and pig it. Take 20 pounds of that alloy and 76 pounds of zinc and melt them together. Then add 4 pounds of aluminum. An alloy similar to the one mentioned that gives good results in brass founding practice contains 85 per cent zinc; 10 per cent copper, and 5 per cent aluminum.

Desires High Strength With Excellent Machinability

> Can you give us several analyses for semisteel for casting pulleys? The pulleys will weigh 1000 pounds or more, and no section will be less than ¾-inch thick. We would like to have a mixture that will give us the strongest semisteel, but it should be soft enough so that it is easily machinable.

It is not possible to get the strongest material say 50,000 pounds per square inch tensile strength or over, and retain the best machinability. The best all around irons combining reasonable strength and good machinability will be found in those with 36,000 to 44,000 pounds per square inch tensile strength. Electric or air furnace processes will give iron containing from 2.70 to 2.90 per cent total carbon and 2.20 to 2.40 per cent silicon which casts dense and is readily machinable. If more expense is justified or the sections are quite unequal, iron with the carbon content given, with the silicon lowered to 1.50 to 2.00 per cent, and about 1 per cent nickel with possibly 0.25 to 0.35 per cent chromium, will prove good, and give a slightly higher strength. The brinell hardness will be from 200 to 240 in the ¾-inch sections.

If the cupola process is used and no experience has been had with high steel mixtures, the carbon may be reduced to 3.00 to 3.25 per cent by using from 25 to 40 per cent steel scrap. With such higher carbon irons, the silicon must be reduced to retain strength and hardness. The silicon content should range from 1.25 to 1.75, averaging about 1.50 per cent. Lower silicon from 1.0 to 1.25 per cent with 0.50 to 1.0 per cent nickel gives a good mixture, and up to 0.25 per cent chromium may be added. There are a number of mixtures which might be used, but those given are typical. The casting as a whole and not one section must be considered if accurate recommendations are to be offered.

Beeswax Employed for Patterns in Lost Wax Process

> Can you give me a formula for wax such as used in making patterns for the lost wax process?

Usually plain beeswax is employed to make the patterns for the lost wax process of molding. However, sometimes it is necessary to harden the wax, and that may be accomplished by ad-

Special buses of modernistic design and accommodating 90 passengers will be used to show visitors the sights at A Century of Progress in Chicago next year

ding rosin or paraffin. The rosin is added in the proportion of 1 part rosin to 2 parts beeswax. To overcome shrinkage, a little venice turpentine is added.

Blows in Bronze Caused by Metal Cores

We are sending for your inspection a small casting made from the 80-10-10 alloy with which we are having difficulty. The casting which is 2⅜ inches in diameter and 2 inches long is poured at 2200 degrees Fahr. around a metal chill in the center which forms a fluted hole in the center with an average metal thickness of ½-inch. Although the chills have been sandblasted, dipped into waterglass, dried and painted with kerosene and lampblack, the metal will not lay up to the chills. The castings are gated at the bottom. Can you give us any suggestions to overcome our trouble?

It is suggested that after the chills are sandblasted, that they be coated with linseed oil, and then roll them in extremely fine silica or clean lake sand that has been dried thoroughly. Just get a thin layer of the sand on and see that the chill is covered completely. Then place the chills in the core oven and dry them thoroughly so that the sand assumes a deep brown color. That method is used in coating chills for hinges or butts, and it should work satisfactorily for the castings you are making.

Water Front Cores Must Be Made Permeable

We are having trouble with L-type or angle water fronts for stoves, both in porosity and breaking down of cores. Is there any special way of making and gating these fronts whereby they can be produced satisfactorily?

The water fronts you refer to undoubtedly have only two openings which serve as water inlet and outlet, and during the pouring operation provide the only outlet for the core gases. To provide maximum permeability the cores should be made from an open sharp sand bonded with the minimum amount of binder. No molding sand should be used as it will reduce the permeability. If the cores have a tendency to collapse while green, addition of a small amount of cereal binder will provide the necessary green sand strength.

Four core rods are used in making the cores; two in the side and two in the front with those in front extending through the core prints forming the water openings. The rods in the side section are laid in so that they rest directly on those in the front section. When the rods are withdrawn, two practically continuous passages are provided, extending from the side and across the front section. After the core is dried, the undesired openings formed at the four points are plugged with pinches of core sand, and the core is baked a second time to dry those portions.

The core is held in place by the two core prints at one end and Z-shaped chaplets in the cope and drag. Be sure that the chaplets are perfectly clean as rust will cause blows or leakage. The vent opening from the core prints should be continued if possible through the mold to the atmosphere by boring holes in the flask at the proper points, and using rods when ramming up the sand. If the cores are vented properly, the molds may be gated at the top or at the bottom.

Loss in Cupola Is Not an Accurate Value

Can you refer me to any published data on the melting loss in a cupola. In our 48-inch cupola we melt a mixture of 60 per cent scrap and 40 per cent machine cast pig iron. The blast pressure is 9 ounces. Our cupola melting loss is 4 to 4.5 per cent and I should like to know how this checks up with the loss in other foundries.

Before touching upon a few of the many variables which enter into the calculation of melting losses in the cupola, it may be sufficient for your purpose to learn that your loss of 4 to 4.5 per cent—presumably calculated carefully—represents ordinary or normal cupola practice. The reason we insert that clause "presumably calculated carefully" is because the cupola melting loss is an item that is calculated *by difference* and as a result it usually represents a guess rather than something secured by actual calculation.

For example each charge that goes into the cupola—we presume the charge is 2000 pounds in your 48-inch cupola—is only an approximate 2000 pounds. Under close supervision or in the hands of a careful man the amount may vary between 1975 and 2025 pounds. In periods of stress or hurry the conscience of a charging man will tolerate variations between 1900 and 2100 pounds. Therefore, while the charging card or cupola record for a 10-ton heat shows that ten 2000-pound charges were placed in the cupola, the actual amount may have been 1000 pounds over or 1000 pounds under. Naturally an elusive factor of that kind will affect the accuracy of a final calculation designed to show the melting loss.

A fairly close check can be kept on the amount of iron tapped from the cupola. The cleaned castings can be weighed. The gates and sprues, the over iron and the miscellaneous spills also can be weighed. Usually the difference in weight between the sum of these items, and the amount of iron charged in the cupola is accepted as the melting loss. For all practical purposes this is sufficient, but it is not technically correct, since part of the difference is due to iron remaining in the sand in the form of shot and small scrap, iron removed with the cupola drop, iron removed by the grinding wheels and tools in the cleaning room. Properly speaking, the melting loss only applies to iron lost in the melting process, that in iron lost through oxidation or in the slag.

Several years ago the American Foundrymens association attempted to settle the question you raise "What is the melting loss in a cupola?" The reports from five general jobbing shops showed losses ranging from 4.3 to 13.6 per cent. In four light jobbing shops the loss was from 4.00 to 6 per cent. Three light machinery shops showed a variation of 2.00 to 11.3 per cent. Four heavy machinery shops ranged between 4.00 and 8.4 per cent. Other classifications included stove plate 2.00 to 4.5 per cent; sanitary ware 3.00 to 7.9 per cent; agricultural 3.6 to 5.3 per cent; railroad castings 3.9 to 6.1 per cent; floor plates, grate bars, etc., 6.2 to 7.3 per cent; car wheels 2.1 per cent.

Close Sand Causes Cracks in Nickel Alloy

We are having some trouble from small nickel castings having a composition of 90 per cent nickel and 10 per cent tin. Appearance of these castings when they leave the foundry is satisfactory, but after machining, the outside surfaces have cracked in several places. The castings are cylindrical in shape and the outside diameter, after being machined is about 1 3/16 inches, the inside diameter ⅞-inch and the length about 1½ inches, and we are enclosing several small pieces of this metal and would like your advice as to the trouble and how we can cast these satisfactorily, maintaining the present composition. We might further add that this metal is melted in a small crucible on a coal fire, without forced draft.

Use a fairly open sand for molding your nickel-tin alloy, as fine brass sand, is not suitable. Use a No. 1½ grade Albany sand for molding. Add from 0.75 to 1.00 per cent of metallic manganese with the nickel. The latter must be manganese metal and not ferromanganese, otherwise the iron will be too high. Porosity can be prevented by adding 1½ ounces of magnesium per 100 pounds of nickel, and if the metal is still too brittle lower the content of tin.

Viewing Foundry Developments

At Short Range

RECENT tests completed by an automobile manufacturing company under simulated service conditions showed that a gray iron camshaft gave 180 hours of continuous service under changed directional stress as compared to 78 hours for a forged camshaft previously used. A factor in favor of gray iron camshafts is the low production cost since dies used in forging these parts are high in cost and comparatively short-lived.

♦ ♦ ♦

A new principle of propeller wheel construction developed by Federal-Mogul Corp., Detroit, was employed on MISS AMERICA X, the successful entry of Gar Wood in the recent Harmsworth trophy race. It is claimed the design completely counteracted blade distortion occasioned by tremendous thrust load and centrifugal force of propeller speeds in excess of 7600 revolutions per minute developed by 6400 horsepower.

♦ ♦ ♦

College engineering laboratories offer a desirable field for informing engineers of the merits of castings. Through courtesy of the Malleable Iron Research institute, 69 colleges now have permanent exhibits of malleable castings and many have been provided with test bars for experimental use of students.

♦ ♦ ♦

A NEW dial type bath room scale now on the market is constructed almost entirely of gray iron castings. Total weight is 17 pounds of which approximately 15 pounds is in the form of castings. The scale is lower than the usual types, thus reducing the mental hazard of standing on the platform. Finished in attractive colors, it is priced between $5 and $6.

♦ ♦ ♦

Heat resisting irons containing 5 to 7 per cent silicon have been developed in Great Britain, which oxidize only slightly on the surface and show a growth of 5 per cent or less after heating for 7½ hours at 1832 degrees Fahr. A further development of that material containing in addition to the high silicon, 17 per cent nickel and 3 per cent chromium had an untarnished surface and a growth of 1.3 per cent under the same conditions.

♦ ♦ ♦

In welding gray cast iron, careful preheating of the entire casting to a good red heat is by far the best means of assuring that expansion and contraction of the metal will be even throughout. After welding, a reheating and controlled cooling or annealing will eliminate internal stresses. Also, preheating and slow cooling are essential factors in producing a proper gray iron structure in the welded casting.

♦ ♦ ♦

ONE automobile manufacturer has developed a heat treated cast iron for valve tappets which is cast in metal molds, softened at 1700 to 1750 degrees Fahr. and cooled in air. The parts are machined and rough ground, then heated from 5 to 30 minutes between 1550 and 1750 degrees Fahr., and quenched in oil. After quenching the tappets are finish ground.

♦ ♦ ♦

An English firm has patented a series of light aluminum alloys containing from 1.30 to 2.25 per cent copper; 1.30 per cent nickel; 0.10 to 1.60 per cent magnesium; 1.0 to 1.40 per cent iron; 1.25 to 2.20 per cent silicon; 0.10 to 0.18 per cent titanium, and remainder aluminum for sand and die castings.

♦ ♦ ♦

Use of black magnetic oxide rouge for polishing specimens has become standard practice in the metallographic laboratory of a West Coast university. According to test, it is cheaper, cuts faster, and gives more perfect surfaces than any material so far tried. An apparent disadvantage, however, is the persistence with which its color remains on clothing, hands and equipment. Black magnetic rouge is obtained by a patented process of precipitation and consists of 99 per cent Fe_3O_4. In the tests, a quantity of the rouge was suspended in water and used as final polishing medium without levigation.

♦ ♦ ♦

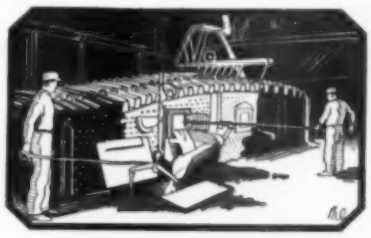
Within the past year, there have been a number of interesting applications of centrifugally cast materials. One installation of a continuous strip mill for steel had over 100 centrifugally-cast conveyor rolls of iron having a brinell hardness of over 275.

♦ ♦ ♦

RESERVOIRS for automobile shock absorbers, first developed as forgings, now are being produced in malleable cast iron. Shock resistance, ease of machining and close grain all are factors in opening this large and expanding field to malleable.

♦ ♦ ♦

Retaining the heat in open-hearth bottoms during periods when the furnace is idle is accomplished at one open-hearth shop by the application of a coat of tar. The same end is attained in another open-hearth department by covering the bottom with a layer of coke breeze when it reaches a temperature of about 500 degrees Fahr.



♦ ♦ ♦

Small additions of alloys to gray iron, such as 0.15 to 0.50 per cent nickel with 0.15 to 0.30 per cent chromium, are being used to retard deterioration from growth, heat and corrosion in hot zones of gas lines and manifolds used in paper mills where combustion of sulphur forms sulphur dioxide.

♦ ♦ ♦

Liquid quenching of alloy steel castings, particularly in the low carbon range is capable of increasing by 50 per cent the ultimate strength and yield point characteristics above those obtainable in the metal in the normalized condition.

The FOUNDRY Family Photograph Album

Upper Left
R. T. TURNER
Shepard Niles Crane & Hoist Corp.,
Montour Falls, N. Y.

Upper Right
D. R. WILSON
Wilson Foundry & Machine Co.,
Pontiac, Mich.

Lower Left
DON MCDANIEL
Hamilton Foundry & Machine Co.,
Hamilton, O.

Lower Right
A. A. POTTER
Purdue University,
Lafayette, Ind.

Men of Industry

Whose Activities Are Making Foundry History

HERMAN H. LIND, who for the past 2 years has been identified with the foundry industry as general manager of the Malleable Iron Research institute, and who more recently has been engaged in private practice as a business consultant, has been made manager of the National Machine Tool Builders association. Previous to his connection with the malleable institute Mr. Lind was for 17 years employed by the Ohio Body and Blower Co., Cleveland, where his activities included direction of plant operation, sales, engineering, manufacturing and accounting. Mr. Lind was born in Canton, O., and was educated in the public schools of that city. His first position was with the Columbus Buggy Co., Columbus, O., where he was employed for two years prior to accepting his first position with the Ohio Body and Blower Co.

E. V. RONCERAY, president, Association Technique de Fonderie, is being promoted in the Legion of Honor for his devotion and untiring effort in promoting the interests of the foundry industry, of the French association and of the High School of Foundry, according to an announcement of the under-secretary of state for technical education at the formal opening of the Fourth International Foundry congress in Paris on Sept. 14. Mr. Ronceray, who already is a Chevalier of the Legion d'Honneur, also has devoted considerable time and work to the education of apprentices.

LOUIS E. UNDERWOOD, managing engineer, stationary motor engineering department, General Electric Co., Lynn, Mass., has been appointed manager of the Pittsfield, Mass., works of the company succeeding E. A. Wagner, who has retired. Mr. Underwood was graduated from Sheffield Scientific school, Yale university in 1896 and joined the General Electric organization in 1897.

FRANK J. OLIVER JR. has been appointed co-ordinator of the college of engineering, University of Detroit, Detroit. The college is one of the co-operative engineering schools which places emphasis on practical work in industry. Mr. Oliver's work will include the placement of students in the Detroit industrial area, which offers splendid opportunities for co-ordination in all phases of engineering.

HARDIN D. THWEATT, formerly identified with the Adamson Machine Co. Baldwin-Southwark Corp., has been appointed representative in the Akron, O., district of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. He will maintain offices in the First National Trust building, Akron.

WALTER J. KOHLER, president, the Kohler Co., Kohler, Wis., manufacturer of plumbing and heating units, was nominated for governor of Wisconsin on the Republican ticket at a primary election, Sept. 20. Mr. Kohler served as governor from 1928 to 1930.

W. H. SCOTT has been appointed general sales manager, the Duriron Co., Inc., Dayton, O., succeeding T. D. SLINGMAN JR., resigned. Mr. Scott has been connected with the Duriron Co. for 13 years, having been in charge of the Atlanta division and later the Philadelphia territory. In 1929 he was made sales manager of the industrial department and head of the technical department.

Chromium Alloy Specifications Proposed

Technical Association of the Pulp and Paper Industry recently has prepared a proposed specification for chromium-nickel-iron castings of the 18-8 type which are to be used by the sulphite pulping industry. Material for the specification was secured by the materials of construction committee of that association through an examination of the literature on the alloys, a metallurgical examination of the castings that failed in service, and the experience of producers of the alloys. A symposium on the proposed specification was held at the fall meeting of the association at Holyoke, Mass., Sept. 14-16. It is planned to present tentative standards for adoption at the annual association meeting to be held in February, 1933. A group of producers of this class of alloys and metallurgists identified with the industry met in Buffalo, Oct. 4 to consider questions relating to the specifications.

British Groups Hold Joint Meeting

The Iron and Steel institute and the Institute of Metals met jointly in London, Sept. 12 to 15. Among the papers presented were the following: "Corrosion-Fatigue of Metals" by Dr. H. J. Gough; "The Removal of Gases from Aluminum Alloys by Mixtures of Nitrogen and Volatile Chlorides" by J. D. Grogan, and T. H. Schofield; "Constitution of the Lead-Tin Alloys," by D. Stockdale; "Researches in Beryllium," by H. A. Sloman; and "The Open Air Corrosion of Copper," by W. H. Vernon.

Ceramic Society Will Meet in Chicago

The 1933 summer meeting of the American Ceramic society will be held in Chicago during the week of June 25 at the Century of Progress exposition. That week also has been designated as "Engineer's Week" by the exposition authorities. The Ceramic society will participate in the engineer's banquet which will be held at the Stevens hotel on the evening of June 28, and hold joint programs with several engineering societies as well as with the American Association for the Advancement of Science.

Brass Specification

Specification QQ-B-601 for brass castings (to be brazed), recently has been adopted by the Federal specifications board and will become mandatory upon all departments and independent establishments of the government on Dec. 15, 1932. Copy of the specification may be obtained from the superintendent of documents, government printing office, Washington for 5 cents.

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Was Enthusiastic

TO MR. PENTON:

It does not seem like 40 years ago that I received a letter from Mr. Obermayer, telling also of your first issue of THE FOUNDRY, asking me to get subscriptions from the molders at $1.00 per year and send them to you in Detroit, which I did, and my first shop was the Thos. Claridge Co., in Kalamazoo, Mich. Mr. Obermayer was very enthusiastic over the paper, and as I remember, the front page had their advertisement.

In those days it was just four of us traveling for the Obermayer company: Kingsland, Hibbs, Hill and myself, and when I look back on the 44 years, the 22nd of July I started out for the Obermayer company. Mr. Obermayer took me to Detroit, and we stopped at the Old Russell House. We went down to the Detroit Stove Co. and there met Ed Barbour and Lathe Croley and they helped make out my trip through Michigan. Those were great days. All we had to do was to sell four tons of seacoal and we made our salary and expenses for a week. My salary was $12.50 per week.

I have taken THE FOUNDRY all these years, and look forward to getting it every issue. It is certainly educating the foundrymen, and is also giving the buyer a place to look for his materials.

With my very best regards, and hoping for the continued success of THE FOUNDRY, I remain.

GEORGE F. CRIVEL

George F. Crivel & Co., Inc.
Buffalo.

Just Another Depression!

TO THE EDITORS:

I want to congratulate THE FOUNDRY and all the members of its staff, and particularly our good friend John A. Penton, on having achieved its 40th anniversary and accomplished so much in that span of years, particularly in the fulfillment in so splendid a way of the promises made in THE FOUNDRY'S Salutation to the Industry, Sept. 10, 1892.

What a pity that this period in THE FOUNDRY'S progress was reached during such a depression. Here's hoping that when the Golden anniversary rolls around, in contrast to this, the 40th anniversary, everything will be at the peak and everything auspicious for a great production on that special occasion.

C. E. HOYT

American Foundrymen's Association

He Knew Him When

TO THE EDITORS:

I have noted in this month's issue a photograph of John A. Penton, founder and first editor of THE FOUNDRY. I take but little credit for his success, but through my humble effort I helped to launch him upon his wonderful career. This in itself is some little pleasure to me. In other words I have tried to make the journey of friends through life a pleasurable one. Owing to this fact my cup of happiness is overflowing.

JOHN HILL

Hill & Griffith Co.
Cincinnati.

Appreciates Service

TO THE EDITORS:

I must congratulate you on the service which you are rendering to the foundrymen throughout the country.

JAMES B. BERTRAM

John Bertram & Sons Co. Ltd.
Dundas, Ontario

Time for Action

TO THE EDITORS:

The sobering influence of the depression makes big things look small and small things mighty big. Man is the champion forgetter of the world.

Industry is in its present condition mainly because we have all been living, all of us, you and I, the wrong way. It will not help matters to ask who is to blame for our present condition in the malleable iron industry. The interests of all of us have become so interwoven, that honest co-operation and concilliation is more and more essential to peaceful progress.

Common men play an important part in the world, but we all recognize the fact that they will not get far without the leadership of superior individuals. In every emergency we call for an individual capable of wise leadership. The Republicans and Democrats, in Congress, united in wooing prosperity. Many societies have banded together to assist in bettering conditions.

Only recently the rubber industry, in a chaotic condition on account of making volume sales followed by great losses, has formed a strong committee assisted by interested bankers to clip the wings of price cutters, or so-called *Peacocks*. The movies, baseball, sugar and others have their Will Hays and Judge Landis. Recently the American Iron & Steel institute elected a man as *dictator*.

If all in and out of the malleable industry will present a solid front, act manly, give their best to the cause as a whole, there can be but one result. The Sherman law prevents manufacturers from fixing prices, but there is no law to prevent individual determination not to sell below cost and invite others to do the same. Has not the hour come for the question to be asked, where is the courage, the sense of social justice that fails to meet this issue like men?

This throbbing issue calls for action now!

If each malleable producer will only have the courage to take a profit he will be doing his bit to end the depression. We cannot be any worse off than we find ourselves today, so why not try something new?

To adopt a schedule of prices with a discount means a lot of grief, but who has had more solid grief than the malleable iron man? This sort of grief in getting a schedule adopted would be much more remunerative than the ridiculous fact of contributing to the consumer over $100,000 each month, by selling below cost.

It is up to the industry to say whether a dictator, devoting all his time, playing no favorites, gathering in the strayed sheep, would solve the problem. It is apparent we can't go it alone.

It will mean a long and sometimes disheartening pull at the outset, but I firmly believe with concerted effort at this time, we will eliminate the old saying "survival of the fittest."

JOHN T. LLEWELLYN, *President*
Chicago Malleable Castings Co.,
Allied Steel Castings Co.

Responsible

TO THE EDITORS:

Congratulations on the fortieth anniversary of THE FOUNDRY.

The Gray Iron institute extends its felicitations on your successful record and your future as well.

The constructive force which your publication has been in the foundry industry for these years I am sure has been responsible for a great deal of progress recorded by castings producers.

ARTHUR J. TUSCANY

Gray Iron Institute, Inc.
Cleveland

ALBANY SAND

CAREFULLY GRADED LABORATORY TESTED

Our influence depends not so much upon what we know, or even what we do, but upon the results we achieve.

Dependable!

We Guarantee Every Car

Albany Sand & Supply Co.

Albany, N. Y.

Producers and Shippers of The World's Best Molding Sand

Announces Retirement From Supply Firm

SAMUEL T. JOHNSTON, for many years vice-president of the S. Obermayer Co., Chicago, manufacturer and distributor of foundry supplies and equipment, retired from active service with that company, Sept. 15. It is announced that Mr. Johnston will continue as president of the Standard Sand & Machine Co., Chicago.

Born and educated in Glasgow, Scotland, where his father was respected as a leader in business and civic affairs, Mr. Johnston came to America as a young man. He secured a position under J. H. Whiting, at that time general superintendent of the Detroit Car Wheel Co. Later Mr. Whiting organized the Detroit Foundry Equipment Co. and engaged Mr. Johnston as salesman. The connection continued for 10 years during which time the Whiting plant was removed to Harvey, Ill., and then he joined the force of Obermayer company and in various capacities has remained with that company up to the present.

Popularity and respect in which Mr. Johnston is held throughout the industry is a tribute to his personality and to his intimate and active contact with the foundry world and those associations and organizations that serve it. He was affiliated early in its history with the Western Foundrymen's association and was secretary in 1896 when the western group with Philadelphia organization laid the groundwork for the establishment of the American Foundrymen's association. As a charter member, director, vice-president and president, he has been closely identified with the A. F. A. throughout its existence and never has been absent from an annual convention.

His record with the A. F. A. is unique. He served two terms as vice president, in 1908 and 1909 and again in 1927 and 1928. He was a signer of the application for charter when the association was incorporated in 1916. Following his second term as vice-president, he accepted the presidency.

The Third International Foundry men's Congress occurred during Mr. Johnston's administration and he headed a delegation of about sixty Americans composing the overseas party. In the tour of England and Scotland which preceded the sessions in London and during the convention he represented his countrymen on numerous occasions as spokesman. His addresses, backed by the charm of his personality, intensified the friendly and hospitable attitude of the groups and individuals who received the visitors on behalf of the British foundry industry. He presided as president at the session of the Foundrymen's Internationl committee which consists of representatives of the leading foundry organizations of Europe and America.

Mr. Johnston also was active in the organization of the Foundry Supply association. He was closely associated with the establishment of the Foundry Equipment Manufacturers' association in 1919 and was president of the group in 1926.

In retiring from active service, Mr. Johnston retains his interest in the Obermayer company and it is certain that he will retain his interest in the foundry industry and the organizations therewith affiliated.

His home address is 175 Addison road, Riverside, Ill., where he and Mrs. Johnston have lived for more than thirty years. For nine years he was a member and president of the Riverside board of education, and was recently elected president of the Riverside public library.

A. F. A. Submits Pattern Color Standards

Standard specifications for color marking of wood foundry patterns and core boxes have been submitted by the American Foundrymen's association to the American Standard association for approval as American recommended practice. The standard color markings provide correct information regarding location of cores, surfaces to be machined, etc., and insure preparation of the mold in the proper manner. These specifications were developed by a joint committee organized by the American Foundrymen's association, and in 1926 the joint committee approved a tentative draft of the standard. It also was approved as a commercial standard by the bureau of standards and published with the designation CS19-30.

Distribute Data Covering Refractories

During the coming year the committee on refractories of the American Society for Testing Materials will undertake a wider distribution of information and data regarding standards which relate to refractories. It is planned to compile all standard specifications and test methods on the subject in a booklet, which also will include the manual of interpretation of refractory test data first issued in 1930. Officers of the committee are as follows: Chairman, G. A. Bole, Ohio State university, Columbus, O.; vice chairman, E. H. Van Schoick, Chicago Retort & Fire Brick Co., Chicago; secretary, C. E. Bales, Ironton Fire Brick Co., Ironton, O.

Studies Effect of Size on Iron Properties

Bulletin No. 72 recently published by the engineering experiment station, Ohio State university, Columbus, O., entitled "The Effect of Size of Specimen on the Strength and Elastic Properties of Cast Iron," by A. H. Dierker, presents the results of investigations on a series of bars ranging from ¼ x 2 inches to 4 x 4 inches from which test specimens were sectioned.

The results obtained indicate that molding conditions being equal, deformation per unit stress varies according to size of section, and that reasonably good physical properties can be secured in gray cast iron without resorting to unusual compositions or excessively high temperatures.

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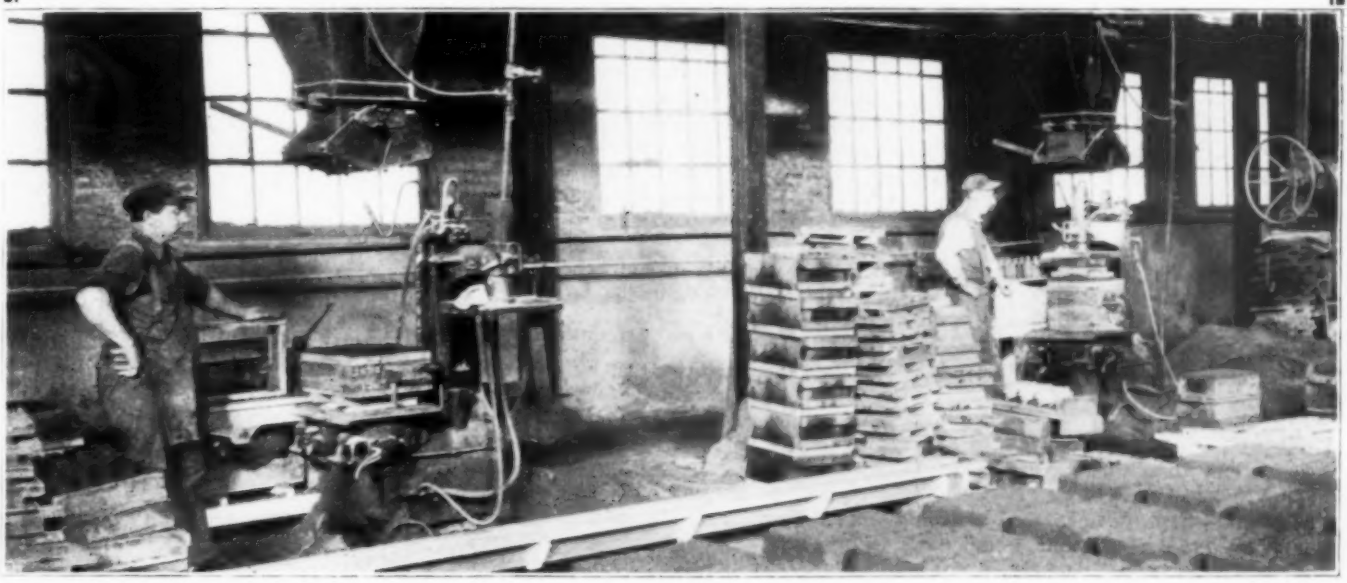

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

PRACTICE of placing shrink heads or feeders on bulky castings or on castings with variations in section thickness, is one of the oldest in the foundry and prevails in both branches, ferrous and nonferrous. In many instances these extra bodies of metal serve the purpose for which they are intended, but in other instances they are responsible for depressed areas, shrink holes and porosity in the immediate vicinity. The process of passing from the liquid to the solid state is exceedingly complicated in some castings. Perhaps it would be more accurate to say that while the actual change from liquid to solid is the same in all castings, the process is subject to more interference, to the effect of complicating features in some castings, than it is in others.

Several investigators have claimed that shrinkage in castings, with practically few exceptions, can be prevented be pouring the metal slowly through a small gate at the bottom of a high sprue. This feature in relation to iron castings was discussed in No. 1 and No. 9 of the present series, published in Jan. 1 and May 15, 1931 issues of THE FOUNDRY.

Several years ago F. W. Paine, a prominent San Francisco brass foundryman introduced a system of pressure casting in his foundry with highly gratifying results. Claims advanced for this system include: Elimination of shrinkage, heads and risers, troublesome shrinkage defects and porosity; production of denser castings; reduction of cleaning room cost as a result of not having to remove large gates, heads or risers.

Cast Under Pressure

ON SEVERAL occasions The Foundry has presented articles dealing with radical methods of gating castings which have been tried by foundrymen with the true pioneering instinct. Possibly and quite probably many readers are thinking and perhaps experimenting along the lines touched upon in the present article, a resume of the activities of a prominent west coast foundryman. He found that practically all the trouble incident to shrinkage and porosity could be eliminated by pouring the metal through small gates connected to sprues that extended high above the cope. Hot metal is an essential feature in pouring castings under the so called pressure system and the use of a pyrometer is recommended to insure satisfactory temperature readings.

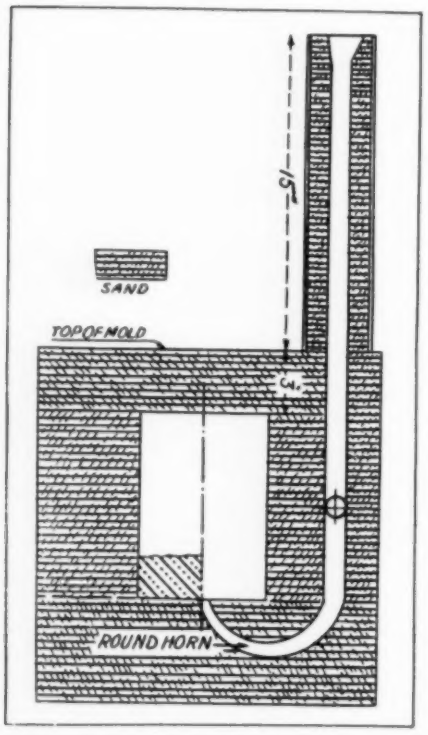

Fig. 174 — Solid bushing poured through an 18-inch head

Produce Solid Castings

In a preliminary test he cast some 4, 5 and 6-inch diameter solid phosphor bronze cylinders 12 inches in length without feeders on top. He varied his method slightly from that shown in a method which he had seen described. Instead of pouring the metal through a square gate at the bottom, he employed a small horn gate ½-inch in diameter where it entered the mold in the center of the bottom end.

The horn gate was connected to a 1-inch vertical sprue which extended 18 inches above the top of the casting. Although no provision was made for feeding the casting in the ordinarily accepted sense of the term, a perfect casting was taken from the sand in each instance. All the remaining castings on the order were cast successfully in the same manner. One of these casting machined near the top presented a perfectly clean and solid surface. The method of gating is shown in Fig. 174.

Fig. 175 represents a heavy bronze bushing which ordinarily would be poured through a heavy gate on one side near the top and with a heavier riser on the opposite side. This casting probably would show a shrunken area in the vicinity of both, a feature that might render the casting useless. This bushing was poured through a small round horn gate connected to a vertical sprue which extended 22 inches above the top of the

(*Continued on Page* 40)

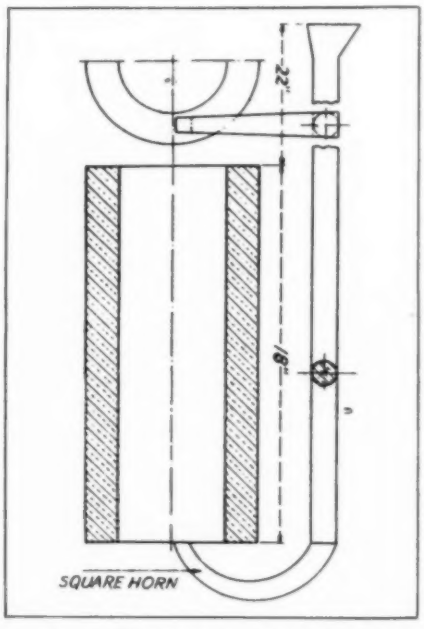

Fig. 175—The head on this bushing was 22 inches above the top

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3rd Crucible furnaces are *most* economical in maintenance costs, because they require no expensive accessories, no frequent replacement or repair of equipment parts.

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Ross-Tacony Crucible Co., *Tacony, Phila., Pa.*
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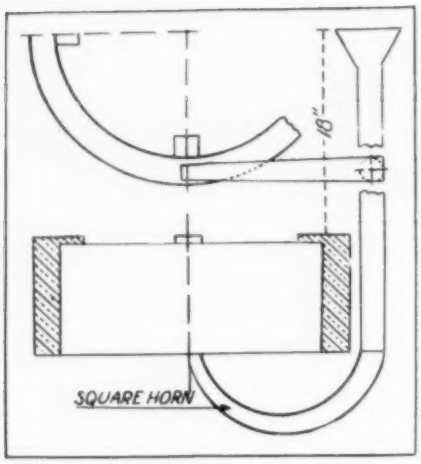

Fig. 176—Metal entered the casting at the bottom

(Continued from Page 38)

casting. About 25 of these castings were poured successfully in this manner.

The heavy locomotive bearing shown in Fig 176 was cast from an alloy containing copper 80 per cent; tin 10 per cent and lead 10 per cent. Several castings were poured successfully in the manner illustrated. Shrinkage cavities, always in evidence with the usual type of gate and riser, were not in evidence on these castings.

Poured Through the Bottom

A drawing of a heavy gun metal nut is reproduced in Fig. 177. Four of these had been made on previous occasion. At that time they were cast with the large end up and were gated with a square gate on the side at the bottom. Each casting was fed for several minutes through a riser $3\frac{3}{4}$-inches in diameter, placed on top. The centers of these castings were so honeycombed with shrink holes that they had to be scrapped. After a great deal of trouble and manipulation the order finally was finished.

Six similar castings produced later under the pressure system presented no difficulty. Five nuts were cast in the position shown and one was cast in the opposite position. In the rough, the castings presented a fine appearance and when the thread was cut through the center, not the slightest evidence of shrinkage was shown. Results obtained with these castings were highly gratifying and helped to offset the grievous memory of the first lot.

Phosphor bronze elevator gears of various sizes are cast every day with heavy gates and risers placed on the face. In many instances the metal shrinks around the gate and riser and renders the casting useless when the teeth are cut in the rim. An elevator gear cast though a pressure gate is shown in Fig. 178. The troublesome features incident to shrinkage have been overcome and these gears are perfect when machined.

Figs. 179 and 180 show a strainer valve body cast from a steam metal alloy composed primarily of scrap. The casting weighs 300 pounds and must withstand a hydrostatic pressure of 500 pounds per square inch. The valve body is so constructed that heavy sections of metal adjoin light sections. These valve bodies formerly were cast through a gate at the side of one of the cylinders and with a heavy riser on the upper flange. The casting always leaked badly in the region of the gates and risers and in the drawn areas where heavy and light sections joined each other.

With a pressure gate entering the casting on the lower flange along side the core and with a sprue extending

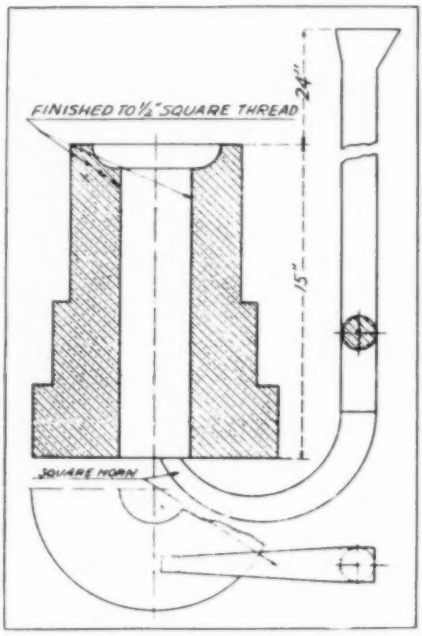

Fig. 177—A square horn gate at the bottom and a 24-inch head produced a solid nut

22 inches above the top flange, the castings have been satisfactory.

A bronze valve seat 31 inches in diameter and weighing 650 pounds is shown in Fig. 181. Two similar valve seats cast previously made with heavy gates on the sides and a heavy riser on the center rib, drew badly around the riser. The valve seat shown in the illustration was cast through a pressure gate on the face and was perfect.

Sand Must Be Rammed

Foundrymen who have made double runners know that they often shrink around the riser placed on the center of the casting. Experience with this type of casting shows that the pressure gating system effectually prevents shrinkage.

No extended experience is required to convince a foundryman that green sand molds must be rammed firmly to withstand the enormous pressure exerted by fluid metal under a high head. Under the pressure gating system the sand must be rammed harder than usual to prevent the casting from straining or from burning in to the face of the mold.

Strainer valve bodies are cast in blackened skin dried molds. Larger valve bodies and other castings similar in general features to those shown in Figs. 180 and 181 also are cast in well blacked skin dried molds rammed evenly and firmly. The mold must be well clamped or otherwise secured to resist the pressure of the metal.

Cores probably have presented more difficulties than any other feature in connection with the system of pressure casting. In the small valve bodies, portions of the core burned in badly and excessive time was required to clean them out. Eventually a core mixture was developed which readily was removed from the casting.

Obviously an ideal core mixture for any casting only can be developed by experiment. Large vent passages, minimum amount of binder and addition of combustible material that will free the sand grains instead of melting into a solid mass are essential features of a suitable core mixture.

Temperature Is Important

Temperature of the metal exerts a great influence in the pressure casting system. Mr. Paine did not employ a pyrometer and therefore does not present any definite data on this phase of the subject. He depended on a well trained eye and poured his castings with what he describes as *hot metal*.

Occasionally when the metal was poured at a temperature cooler than usual small valve bodies were shrunken. Cool metal also produced depressions on top of solid bushings and similar castings. Pyrometric control is recommended for consistently satisfactory results.

The pressure system of pouring castings presents several advantages. No provision has to be made for

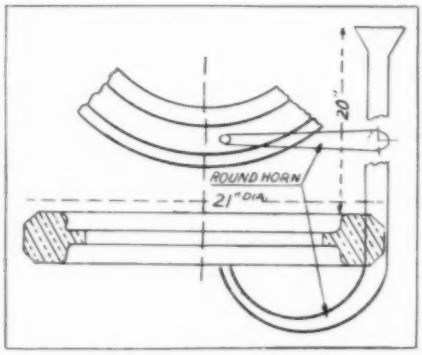

Fig. 178—Elevator gear blank usually presented porous areas until the pressure gate system was adopted

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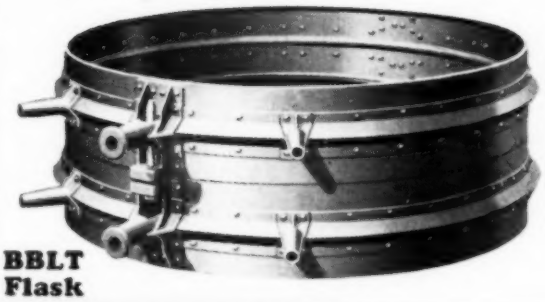

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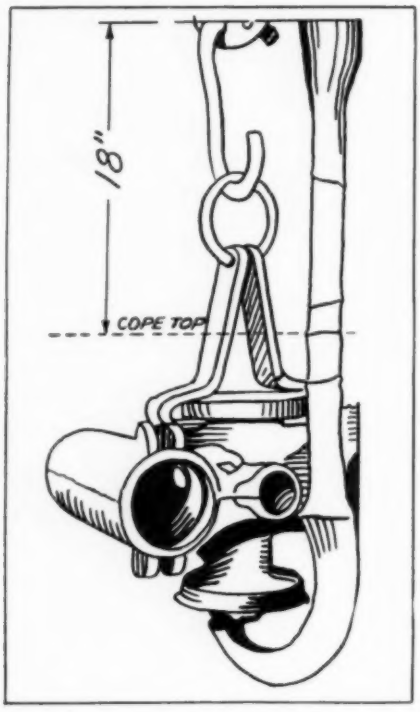

Fig. 179—Showing relative heights of casting, flask and sprue

(*Continued from page* 40)

risers in the cope. Extra metal is not required for heavy gates and risers and many other difficulties arising from their use is not experienced. Repairs do not have to be effected, by burning-in or otherwise where shrinkage has left large cavities under the gate or riser.

Other advantages of the pressure system include entire absence of porous areas at the junction of light and heavy sections, denser castings than those poured in the usual manner, reduced cost of cleaning. The system is particularly applicable to the production of valve bodies, bushings, gears, pump bodies, runners, propellers and many other castings in which dense, clean homogenous metal is a prime consideration.

No opportunity was afforded to apply the pressure system to the production of manganese bronze castings and therefore no data or observations can be presented in relation to that metal.

However, the method was tried with aluminum bronze, a metal which resembles manganese bronze in many respects, but in which the shrinkage factor is more pronounced. A thrust washer was cast from this metal 28½ inches outside diameter, 17½ inches inside diameter and 1⅛ inches thick. The mold was made flat in a 42-inch square flask in the usual manner. The closed mold was turned up on edge and poured in that position through a long sprue that extended from the bottom to a point 27 inches above the top of the casting. When the casting was taken from the sand, scarcely a blemish showed on the surface and when it was machined the surface was as smooth and clean as that of a mirror.

This is the thirty-fourth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The thirty-fifth installment will appear in an early issue. —THE EDITORS.

Book Review

Foundrywork and Metallurgy, Vol. III, edited by R. T. Rolfe, imitation leather, 249 pages 5 x 7¼ inches, published by Isaac Pitman & Sons, London and New York, and supplied by THE FOUNDRY, Cleveland, for $1.75 plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., Caxton house, Westminster, London.

This volume in the series on foundry practice is devoted to discussions of foundry refractories, pyrometry, cleaning of castings and the foundry plant. Vol. I, reviewed previously presents

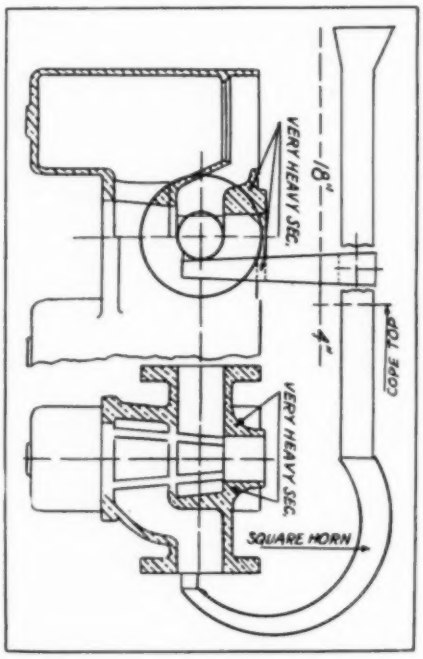

Fig. 180—This casting showed no porosity at the junction of heavy and light sections

information on patternmaking, mold and core making and machine molding, while Vol. II treats with the subjects of molding sands, nonferrous metallurgy and ferrous metallurgy. The various subjects under discussion in the present volume all are matters of daily importance in the operation of the foundry.

The section on refractories wes prepared by Alfred B. Searle, a consultant, and presents information on the use of seger cones to measure the refractoriness of a material; the action of refractory materials under load; general requirements of a refractory material with reference to the various properties; and the general classification and application of refractories.

Under the heading "Dressing, Trimming and Sandblasting," J. McLachlan and Charles A. Otto discuss practices followed and equipment employed in English foundries in cleaning castings. R. T. Rolfe, chief metallurgist. Messrs W. H. Allen, Sons & Co., Ltd., Bedford, has written a complete and interesting discussion on temperature control. The author points out that among the variety of industrial pyrometers, there generally is one type of instrument best adapted to the particular purpose.

The section on the "Foundry Plant," by James Cunningham, is devoted chiefly to a discussion of the various problems of materials handling encountered in the foundry and illustrates the types of equipment used. While this series of books deals primarily with English foundry practice, the broad general principles are applicable everywhere.

Changes Sales Personnel

Wallace T. Montague, connected with the Norton Co., Worcester, Mass., for 20 years, has been made director of sales, abrasive products division.

H. K. Clark, Chicago district manager, grinding wheel division, has been appointed director of sales of the grinding wheel division with headquarters at the main office in Worcester. Mr. Clark has been identified with the Chicago office of the Norton Co. for many years with the exception of a 2-year period when he was sales manager of the Norton plant in Germany.

W. E. Shumway, grinding wheel district manager, Hartford, Conn., has been appointed Chicago manager of the grinding wheel division, succeeding Mr. Clark.

William Pettigrew has been appointed sales engineer of the abrasive grain division, Norton Co., Worcester. Mr. Pettigrew has been a member of the research laboratories of the Norton Co., and has specialized on abrasive developments.

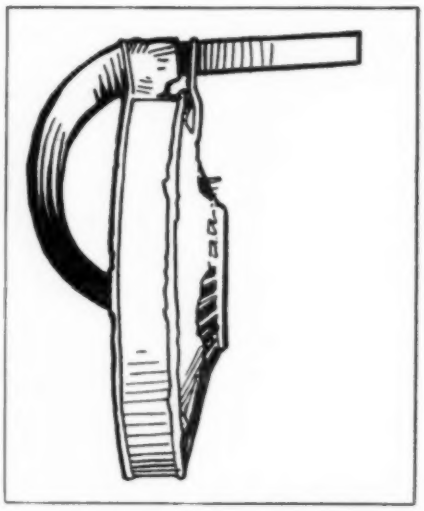

Fig. 181—Showing method of applying pressure gate to large valve seat

Alloying Elements in Malleable Iron

Certain alloys increase tensile strength and hardness and lower the ductility of the iron

SEVERAL possible procedures can be followed in attempting to improve qualities of malleable cast iron. One is by the addition of alloying elements to malleable cast iron. The purpose of the investigation, herein reported, was twofold: (1) To determine the effect of certain alloying elements on properties and microstructure of malleable cast iron; (2) To determine the possibility of developing an alloyed malleable iron that can be surface hardened by nitrogen, i. e., nitriding.

Effect of Alloying Elements

In carrying out the first part of the investigation, the elements, nickel aluminum, chromium, molybdenum and vanadium were selected as most suitable for alloying purposes. Amounts of those metals used varied from 0.25 to 1.25 per cent. From the effects of the elements, when used alone in the material, certain combinations next were employed. An attempt was made to overcome the unfavorable influence of certain elements by preparing alloys of relatively low carbon and silicon contents. Experiments were made to determine the most suitable method of introducing the alloying elements into malleable cast iron. Standard test bars were prepared containing various amounts of the alloying elements.

In discussing the effects of the various alloying elements on malleable cast iron, it is important to note that aluminum is oxidized readily and tends to become entrained in the metal as an oxide. This element also causes molten iron to become sluggish and produces a wrinkled surface on the casting. These harmful effects are minimized by protecting the metal from oxidizing influences.

It is possible to divide the elements investigated into two classes, based on the influence in affecting the condition of the carbon. The first group consists of aluminum and nickel. These two elements cause the carbon to exist in the free state. The second group includes chromium, vanadium and molybdenum. These elements tend to retain the carbon in the combined state. The elements in each group have certain properties in common. However, they are not similar in every respect.

Nickel in small amounts gives somewhat higher tensile strength and ductility to malleable iron. Aluminum lowers the values of those properties. The difference in action of the two elements is due to a grain refinement of ferrite and a tendency of the graphite to precipitate in the form of nodules. Both effects follow the addition of nickel to iron. Graphite resulting from the addition of aluminum is coarse and angular. In that form it is quite detrimental to the physical properties of malleable iron. There is practically no grain refinement accompanying the use of aluminum.

Chromium, molybdenum and vanadium increase the tensile strength and hardness and lower the ductility of malleable cast iron. These effects are due primarily to action of the alloying elements in retarding the effectiveness of the annealing operation. Chromium is the most effective in that respect. Molybdenum and vanadium follow in the order given.

Difference in the effect of annealing process on eutectoid carbides of the three elements is quite marked. The carbides of chromium show a decided tendency to spheroidize. This is not nearly so evident in the case of molybdenum and vanadium.

Many specimens examined offered some evidence in regard to the mechanics of the annealing process. It appears to take place through the medium of solid solution. At the elevated temperature of annealing, the state of equilibrium between the proeutectoid cementite and austenite is disturbed by the decomposition of the carbides in solution in austenite. These are converted into ferrite and temper carbon. The austenite becomes unsaturated, dissolves more of the carbides and these in turn are decomposed.

Eliminate Primary Graphite

To produce malleable iron of commercial importance, it is necessary that the material be free from appreciable quantities of coarse primary graphite. From a study of effects of individual elements, it is obvious that aluminum tends to produce this graphite in cast iron. Chromium, molybdenum and vanadium have the opposite effect of causing the carbon to remain in the combined condition. Experiments were made to determine the ability of the last mentioned elements in counteracting this injurious, graphitizing tendency of aluminum. One and one-half parts of chromium or vanadium are necessary to minimize the graphitizing influence of aluminum. Molybdenum is approximately one-half as effective in this respect.

Aluminum resembles silicon in acting to promote precipitation of graphite. Ordinary malleable iron contains appreciable quantities of the latter element. A section of the investigation was concerned with alloyed malleable iron containing lower carbon and silicon than is usually found in this material. The aluminum present replaces the silicon and the action of aluminum as an excess graphitizing agent is decreased appreciably. The alloy resulting has approximately one and one-half times the strength of ordinary malleable iron.

With respect to the second division of the work, the possibility of

Taken From Thesis

SEVERAL interesting effects of certain alloying elements on malleable cast iron are reported briefly in this article which is an abstract of a thesis presented for a degree of Doctor of Science, Massachusetts Institute of Technology, Cambridge, Mass., by Frederick L. Coonan. The abstract is from "Abstracts of Scientific and Technical Publications from the Massachusetts Institute of Technology" for January, 1932.

developing an alloyed malleable iron that could be nitrided, the work consisted essentially in subjecting alloys of different compositions to the nitriding process. Hardness of the metal and the character of the case was determined.

The results of the investigation concerning the behavior of alloyed malleable iron when subjected to the nitriding process were promising. It is established that aluminum, nickel, chromium, vanadium and molybdenum when used alone in that material do not materially affect the hardness of the product when nitrided. Most of the specimens examined contained large quantities of nitride needles.

Employment of certain combinations of those elements in conjunction with aluminum, however, resulted in an alloyed malleable iron that possessed when nitrided a hardness approaching that of nitrided steel. The hardest case was obtained with approximately 1.25 per cent of aluminum and 0.90 per cent of chromium. If either or both of these two elements are lowered appreciably, there is a decided decrease in the hardness of the case.

Malleable cast iron containing approximately 1 per cent each of aluminum and vanadium when nitrided produces a tough and hard case. Combinations of aluminum with nickel or molybdenum showed little promise as elements to use in the production of malleable cast iron for nitriding.

Malleable cast iron containing approximately 1 per cent each of chromium and aluminum with a low per cent of carbon and silicon produces a hard case when nitrided. It is tougher than that formed in the higher carbon-high silicon alloys.

Malleable Iron Research Institute Discusses Hampering Effect of High Taxes

A QUARTERLY meeting of the Malleable Iron Research institute, held in Toronto Sept. 14 and15, attracted some 30 members from the United States. Led by John C. Notman, McKinnon Industries Ltd. (subsidiary of the General Motors Corp.), St. Catharines, Ont., who is president, the Malleable Iron association of Canada extended hospitality. A number of Canadian foundrymen were present at the sessions of the institute.

At the opening meeting Prof. Enrique Touceda, consulting engineer, reported on investigation of pinhole structure ascribed in some cases to the character of facing employed. Other problems and technical developments were discussed.

Robert E. Belt, secretary of the institute, led a general round table discussion of new and prospective new applications of malleable castings. William J. Raddatz, Cleveland, presented a brief discussion on sales building.

The hampering effect of high taxes which are applied direct to all manufacturing and which work indirectly through freight rates, were shown in graphic form by Secretary Belt. A study of some 20 foundries showed that the increase in freight rates, taxes, power and actual depreciation which totaled $12.63 in 1914 have increased to $26.55 per ton added to the cost of each ton of malleable produced. While wages and costs of metal and fuel are now at the pre-war level, other fixed charges are 110 per cent above that level.

E. E. Griest, vice president, Chicago Railway Equipment Co., and president of the institute, offered a careful analysis of probable trends in castings demand. He showed that in the automotive industry 25,000,000 cars are in service. Of this number 9,000,000 are over five years old and 13,000,000 have passed the four-year mark. In consequence a large potential renewal market exists, although public purchasing power will determine when this market becomes active.

Railway Purchases

Much discussion of probable railway purchases has been prevalent, but no actual railway orders of any size are in sight. It is probable that financial arrangements will be made for equipment purchases, but these will first be directed toward replacement of locomotives. Modern locomotives are more efficient and represent a direct saving of 20 per cent in fuel over the types of motive power of 15 years ago.

While the total of bad order railway cars is about 250,000, which is 100,000 in excess of normal, the surplus figures show over 700,000 cars available above current use. However, some roads are destroying cars and many now listed as idle probably never will be returned to service.

The prospects in agricultural and industrial machinery seem to offer an earlier demand. Increase in farm commodity prices and bountiful crops backed by the proposed expenditure of practically $2,000,000,000 to stimulate business through agricultural road building and public works probably will affect this market.

Prof. G. C. Brett, University of Toronto, was the guest speaker and discussed political conditions in India.

Book Review

Analyzing Our Industries, by Cecil Eaton Fraser and Georges F. Doriot, cloth, 458 pages, 6 x 9 inches, published by the McGraw-Hill Book Co., Inc. and supplied by THE FOUNDRY, Cleveland, for $5.00 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, London.

Fundamental information on developments and trends in certain industries, selected for their interest to business men and investors, is presented in this book. A constructive examination of this kind has numerous points of value; to the manufacture it may permit a change in operations to take advantage of changing trends. Also it presents interesting factors which govern largely the rapidly changing field of distribution. The thought is presented that future important changes to be made by industry probably will apply to distribution rather than to production.

Industries covered include automobiles, motor trucks and busses, rubber, cotton textiles, woolens and worsteds, aviation, machine tools, copper, iron and steel, cement, paper, farm equipment, bituminous coal, anthracite and petroleum. The survey indicates that the automobile industry soon will gain maturity, with fewer manufacturers making more standardized cars under economies of large scale production and closely supervised dealer organizations.

Iron and steel manufacturers, it is predicted, will continue to find greatest interest in keeping production costs on a comparable basis with competitors, in retaining market outlets and contacts, achieving diversification of products and markets and in developing new uses for iron and steel products, particularly in the divisions burdened with a large excess productive capacity.

Is Made Engineer

C. W. Fick, has been made district engineer of the East Central district, General Electric Co., Schenectady, N. Y., with headquarters at Cleveland, succeeding William F. Culver, recently retired after 47 years service with the company.

Southwestern branch office of the Jeffrey Mfg. Co., Columbus, O., has been moved from Houston to Dallas, Texas. T. P. Burke continues as manager of that office.

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YOUR CASTINGS . . . *made with Charcoal Pig Iron have* . . . GREATER DENSITY . ADDED TOUGHNESS . MORE STRENGTH . LESS SCRAP LOSS . GREATER UNIFORMITY . EASIER MACHINABILITY . . . *and you get higher quality finished products.*

A percentage of Superior Charcoal Pig Iron in the mix guards against the chance of turning out defective castings.

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There's always the chance that the castings your foundry turns out will prove defective—and defective castings are dangerous these days. If you don't give your customers the kind of castings they want—and do it consistently—the chances are they'll give their business to another foundry.

There's a simple method by which you can keep the "maybe's" out of your castings. Include a percentage of Superior Charcoal Pig Iron in the mix.

Then you'll *know* that the castings you turn out will be dependable. For Superior Charcoal Iron makes castings stronger, tougher, denser, more uniform. It gives them greater durability and easier machinability. And with charcoal iron in the mix, you'll have less scrap loss, fewer rejections and larger profits.

When you bid on castings, submit two bids. One with straight pig iron—and one to include not less than 15% to 20% Superior Charcoal Pig Iron. More customers than ever before will choose the second bid.

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New York - Boston - Philadelphia

Superior Charcoal Pig Iron

Making Manganese Bronze

(*Concluded from Page* 27)

they had a bad and costly failure, so it became necessary to concentrate on the matter to discover the difficulty. An analysis of the steel alloy gave the following: Tin, 15.56 per cent; iron, 72.05 per cent; manganese, 3.78 per cent; and carbon, 5.91 per cent; practically an alloy of cast iron and tin.

When 2 per cent of such an alloy was added to copper and zinc to form manganese bronze the result was different from that desired. About all the steel alloy added to the bronze was tin. Cast iron and copper would not alloy, for although aluminum was added, there was not enough to throw out the carbon from the cast iron and cause the iron to alloy. After that experience, special supervision was exercised to see that that carbon was kept out, and when that was done the steel alloy functioned in the normal manner.

The author never felt satisfied with the steel hardener, and suggested many times making changes which would make it impossible to carbonize the hardener. However, the management was loath to make such a change, and the shop adhered to the old fashioned hardener, meanwhile making experiments to devise some better way of making the bronze. Many trials were made of different alloys, of which it is only necessary to record a few. Without using a hardener an alloy that may be useful had the following composition: Copper, 67½ pounds; zinc, 27½ pounds; aluminum, 3½ pounds; lead, 1 pound; manganese, ½ pound. The physical properties of that alloy were: Tensile strength 70,500 pounds per square inch, yield point 29,000 pounds per square inch, elongation in 2 inches 35 per cent, reduction of area 30.8 per cent.

The following alloy was made without a hardener: Copper, 57 pounds; zinc, 42 pounds; iron 1½ pounds; ferromanganese, ½ pound; tin, 1 pound; aluminum, ½ pound. Tensile strength was 85,300 pounds per square inch, elastic limit 42,800 pounds per square inch, elongation 21 per cent in 2 inches, and reduction of area 22 per cent.

It is impossible to state whether these results could be expected consistently but with careful manipulation it would not be bad if discounted 10,000 pounds in tensile. The alloy is not expensive.

A manganese alloy without iron and following the ideas of Cowles is as follows: Copper, 44 pounds; *A* grade manganese-copper, containing 30 per cent of manganese, 12 pounds; zinc, 42 pounds; aluminum, 2 pounds. That mixture went consistently from 87,000 to 92,000 pounds per square inch tensile and from 16 to 25 per cent elongation. Another test made without hardener consisted of 56 pounds copper, 42 pounds western spelter, 2½ pounds of 30 per cent manganese-copper and 4 ounces of aluminum. Physical properties of the metal were: Tensile strength 60,700 pounds per square inch, elongation 23½ per cent, reduction of area 25.1 per cent.

While these tests show that manganese bronze can be made by straight alloying of metals and without using a hardening alloy, more consistent results will be obtained by using a hardener.

This is the first of two articles by Mr. Vickers on the production of manganese bronze, the second will appear in the November issue.

THE EDITORS

Castings Star As Movie Props

(*Concluded from Page* 14)

research department of the studio is put to good use. In case several pieces of door hardware of a very ancient type are wanted and cannot be found in any of the antique stores, the research men devise ways and means of obtaining a sample, even if it has to be taken from the door of some old dwelling. This old relic is turned over to the foundryman with instructions to make one exactly like it and they even go so far as to say that the old scaly paint on the sample must not be disturbed in the slightest degree. Some of these old antiques are so badly encrusted with rust and paint, it is almost impossible to get them out of the sand and it has sometimes taken hours of diligent and patient work on the part of the molder to produce a sample casting weighing only a pound or two. Let me say here in fairness to the studio that they will go to almost any expense to get the desired results.

There are times too, when the actor has to carry a heavy pair of revolvers throughout the picture, especially if it is a western type of picture. Not being accustomed to carrying anything so heavy he requests that a pair be made of some lighter material, whereupon a pair will be cast in aluminum and these will be used in all shots except those showing the actual firing of the gun or for close-ups.

And now for a brief story of the first big job the writer had after his association with the R. K. O. studio. It was necessary to produce an ornamental stair-rail for the picture "Dixianna" and at that time the studio had no regular foundry. In fact, their foundry equipment consisted of a furnace made of an old oil drum with a motor from an old vacuum cleaner to supply the forced draft, a 10 pound capacity crucible and about 200 pounds of sand.

After close figuring it was estimated that the castings would weigh close to 14 pounds each. As it was out of the question to get a 14 pound casting from a crucible holding only 10 pounds of aluminum, a No. 20 crucible was purchased. It then was necessary to spend several hours with a hammer and cold chisel chipping out the furnace to enable it to accommodate the larger crucible. The foundry at this time was located in the miniature shop of the studio and there was only sufficient room to ram up one mold at a time. In spite of all the difficulties the castings were gotten out in record time and the set was one of the most beautiful ever produced at the R. K. O. studio.

It is almost impossible to show a picture of any casting made in the studio foundry showing gates and risers attached. Before the metal is cold in the mold, someone is standing at the door of the foundry waiting for the shake-out so that he may go to work on the casting and get it finished for quick installation on the set for which it is intended.

Book Review

Beryllium and Its Alloys, issued by the Central Committee on Scientific and Engineering Research of the Siemens Co., translated by Richard Rimbach and A. J. Michel, cloth 331 pages, 6 x 9 inches, published by the Chemical Catalog Co. Inc. and supplied by THE FOUNDRY, Cleveland, for $10.00 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

Development of industrial working methods and the investigation of properties and commercial evaluation of beryllium are reported in this book from an investigation on the subject carried out at the Siemens-Konzern since 1923. The discussion includes considerable information on the occurrence and methods of producing beryllium, the structure, and properties of beryllium-copper alloys and changes which result from age hardening, and beryllium-nickel alloys. The subject of beryllium-iron alloys which is discussed in one chapter should be of special interest.

Many valuable illustrations are included in this work, which undoubtedly is the most complete collection of information thus far presented on the subject.

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As a boy did you ever try to break up rocks? Remember how hard it was to smash the solid, chunky kind? And how easily the flat "scalers" broke?

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G-5

Economies in Steel Casting Design

(*Concluded from Page* 22)

providing a relatively uniform rate of cooling. There are numerous instances in which such troublesome masses can be reduced by variations of this procedure, with no sacrifice of strength, and often with distinct advantage to the resistance of the casting to severe stresses.

A variation of this method of relief is shown in Fig. 5. The casting was molded in the vertical position, with the ring up . The two views indicate the ways in which the members were relieved by openings, while sharp corners were eliminated. The result was a component of a machine which combined lightness of weight and great resistance to severe stresses. Serious strains were not induced in the solidification of the steel because the design accommodated itself to contraction phenomena.

Pockets Produce Difficulties

Deep pockets which have sharp interior corners, or which are produced by bodies of sand of insufficient area properly to conduct the heat of the surrounding metal, are to be avoided. Such pockets produce the difficulties of sharp corners and also present the disadvantages of difficult removal of sand. If pockets cannot be avoided, as many and as large openings as possible should be made to permit heat transfer and to facilitate removal of sand.

Junctions of bosses or trunnions with other sections of the casting frequently are sources of difficulty. Bosses often are of greater cross-section than members to which they are joined. This inequality gives rise to a serious concentration of heat at the junction. Provisions should be made in such instances for as near an approach to equalization of sections as possible. This may be accomplished by the use of adequate fillets, and by coring out the boss so that its section is comparable to that of the member to which it is joined. This equalization of section not only assists in production of sound castings, but does much to avoid concentration of stresses imposed in service, wherever changes in section are abrupt.

Abrupt changes in cross-section invariably are to be avoided. Expenditure of time to devise ways of avoiding them is repaid amply in improved ability of the casting to meet conditions of service to which it is put. Joining a light section to a heavy section, even though adequate fillets are provided, imposes severe stresses at the point of union, both in the cooling of the casting and under load in service. Such a condition often may be relieved by a proportional thickening and thinning of the two sections to bring them at least to practical equality. This produces a far stronger unit because of the material reduction in stress concentration. It often is found that by an equalization of sections throughout the design, weight can be saved and strength can be increased greatly.

The results obtained by Kommers and Moore in rotating-beam tests upon bars 0.40-inch in diameter show the drastic effect of the concentration of stresses in abrupt changes in cross-section. In each bar the section was reduced to 0.275-inch in diameter at its center. In the bar in which this diameter was reached by a 9.85-inch radius, the endurance limit was 49,000 pounds per square inch. By using a ¼-inch radius, this value was reduced 8 per cent. With a square shoulder, it was reduced 51 per cent, and with a V-notch,60 per cent.

The computation of fiber stress at points of unmodified changes of section is difficult if not impossible because of inability to determine the influence the change exerts in concentrating load stresses. That the influence is great and that such conditions zealously should be avoided whenever possible, is obvious. Fig. 3 shows an excellent example of the use of sweeping curves to avoid radical changes in direction. The flange at *A* swells gradually to accommodate the change from ½-inch to the ⅞-inch metal of the column head, which, in the broad curves of *B* and *C*, forms the union with the upper flange of the extension. Such features not only are desirable from the standpoint of load distribution, but lend themselves admirably to the satisfactory production of the casting.

Fig. 4, showing a cut-away section of a cylinder head casting, is an example of desirable unformity of section and gradual direction changes of various members. Not only is the casting designed to produce an equalized distribution of load, but a simplification of foundry problems is accomplished.

Linear shrinkage of steel, as it cools from the liquid state, involves an actual movement of the casting through the sand. In the case of a perfectly flat piece with no projections such as flanges, bosses, or brackets, normal unimpeded contraction will take place. Presence of such details reduces the measureable contraction because they prevent unrestricted movement. It is not always possible to predetermine the exact extent of this influence on contraction when the pattern is being made, and at times this causes a delay in producing a casting dimensionally correct.

Safeguards Are Applied

Shrinkage or contraction concerns the designer largely because of its influence on the cost of castings. The foundryman must take into consideration the expense entailed by precautionary steps in producing a casting free from cracks and cavities caused by shrinkage or contraction. Many safeguards of practice are applied successfully for this purpose in addition to normal production methods, but they necessitate extra manufacturing expense. The designer, either through his general knowledge of the behavior of the metal in cooling, or through information obtainable from the foundryman, can assist greatly in obtaining a satisfactory casting at a reasonable cost.

The two views of the casting shown in Fig. 1, show the original design of the piece, the molding of which involved the use of complicated interior cores. These cores necessitated not only elaborate and expensive core box equipment but required special attention in their production. They required a special sand mixture and extreme care in setting the cores in position to avoid cracks which were prone to appear

(*Concluded on Page* 50)

Co-operation Needed

CERTAIN factors of design are germane to each method of fabrication, and the industry which best applies the fundamental principles pertaining to design secures a decided advantage over competing methods. This is true in steel castings. Here a knowledge of the characteristics and behavior of the steel in the mold and the practical application of the information in the conception of the casting, will result in economies of manufacture. Continual co-operation between the designer and foundryman is necessary to accomplish the desired purpose.

This article is from a paper presented at the symposium on steel castings before the joint meeting of the American Foundrymen's association and the American Society for Testing Materials at Atlantic City, N. J., in June. The author is general manager, industrial division, American Steel Foundries.

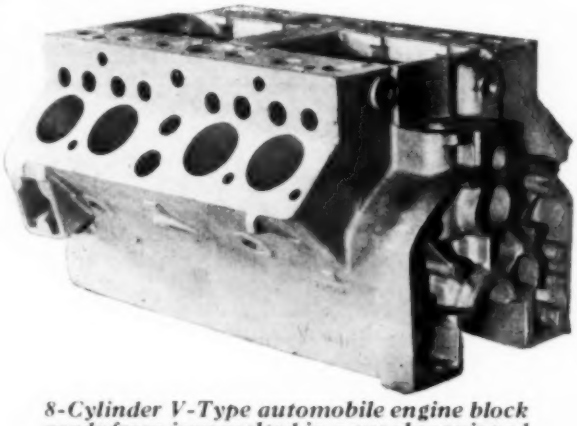
56 Perfect 3¾-in. x ⅛-in. piston rings — cast on one riser from iron melted in cupolas equipped with Griffin Hot-Blast

THIS achievement in fast production of large groups of small-section high-quality castings is made possible *at low cost* through the close metallurgical control and the superheat imparted by the Griffin Hot-Blast Process of melting the metal.

Regardless of what castings you make, large, small, thick, thin, etc., the Griffin Hot-Blast Process would increase your cupola capacity at least 10 per cent, produce your tonnage at a guaranteed saving of at least 25 per cent of the coke and limestone, and would permit you to add *at least 20 per cent more scrap* to the mixture with corresponding saving in raw metal cost and *without impairing the uniformity of chemical analysis and physical qualities of the finished castings.*

If you make intricate thin-walled castings where wall thickness is limited by your melting practice, Griffin Hot-Blast would enable you to make the walls thinner with additional saving in metal—yet your product will be better and your rejections fewer.

To the thermal and net money benefits of hot blast, the Griffin Process further adds the distinct advantage of continuous cupola flow into teapot-spout mixing and reservoir ladle, and transfer to the moulds in *bottom-pouring* ladles, for *triple elimination* of slag and *maximum efficiency of sulphur control,* the latter through introduction of the purifying agent where it is most active.



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The GRIFFIN Hot-Blast Process

(*Concluded from Page* 48)

as the metal contracted over the cores. These precautions added to the cost of production and retarded progress of castings through the shop.

The re-designed casting, shown in two views in Fig. 2, eliminated the use of interior cores, and permitted the pattern to leave its own core when withdrawn from the sand. Cores were required to produce the brackets and ribs on the exterior, but the equipment was simple and the cores were produced at a much lower cost than the interior cores of the other design. The difficulties from cracks were eliminated, for the contour of the new design lent itself to self-adjustment in cooling, and in general proved a decided improvement over the old construction.

It may be said that the weight of a casting does not in direct proportion affect its cost of production. The

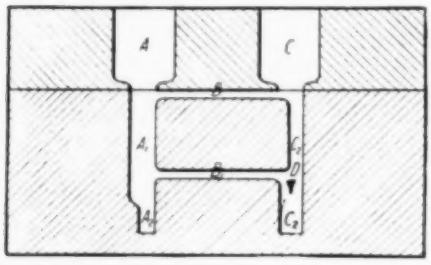


Fig. 9—Sketch showing relation of sections of various thicknesses

greatest single influence in this respect is the degree of intricacy of design. Two castings of the same weight may be at the extremes of high and low production costs. The simplicity of one may assure its rapid progress through manufacturing operations, while the other, due to complicated design, may require special effort at every stage of its production. A premium in selling price must be exacted for this additional cost.

Where equalization is not possible, junctions of unequal members should be as gradual as possible and be accomplished by fillets, tapers or curves. These devices avoid the detrimental concentration of stresses which are not only pernicious in their effect upon the strength of the casting in service, but increase the difficulties of production. The expenditure of time in modifying a design to eliminate or reduce to a minimum the number of cores required usually will be repaid in an appreciable reduction in the cost of the casting.

The staggering of sections as shown in Fig. 10 and the relief of heavy junctions as shown in Figs. 5 and 8, are helpful devices in securing uniformity in cooling rate and in avoiding use of excessive feed metal. Observance of these precautions will do much to reduce the cost of the casting and insure its integrity.

Pattern equipment plays an important part in determining the cost of castings. Whether or not the foundryman is to be intrusted with the manufacture of the pattern, his suggestions as to its construction should be given much consideration. His judgment as to the expense which properly may be incurred is based upon an appreciation of the length of time a pattern may be expected to produce castings of dimensional accuracy.

Frequently quotations for pattern equipment made by commercial pattern manufacturers are based upon the production of the equipment, and not upon its greatest utility in the production of castings. This is likely to prove costly when bids for castings from it are received, and it is possible that the engineer's efforts to produce a satisfactory steel casting design may be defeated.

There are many variations in pattern construction of which the patternmaker may take advantage. Some of these, while lowering pattern costs, impose unnecessary expense in producing the casting. Sections may be attached as loose pieces which would more properly be made by use of a core. A core may be used where the results would be far more satisfactory, if more extensive pattern work permitted the section to form its own core. Construction of pattern equipment should always be given serious consideration and be planned as the result of experience and keen observation. It is not enough that a casting can be produced from a pattern. It must be properly performed.

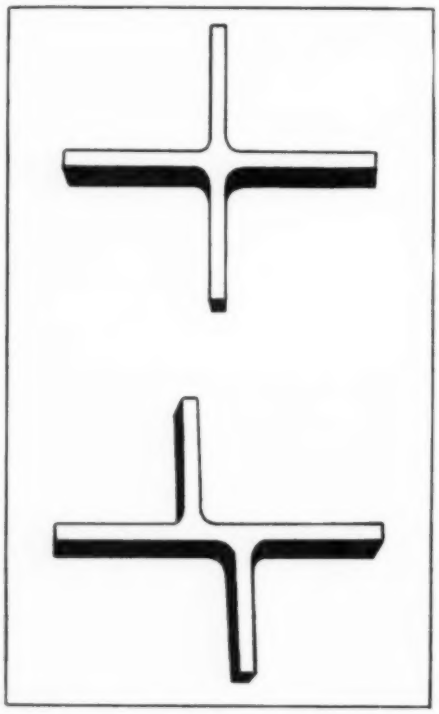


Fig. 10 (Above)—Fillets provide for heat transmission. (Below)—Casting employing staggered section

Describes Bronze In Interesting Booklet

David Brown & Sons, Huddersfield, England, recently has published an interesting, artistic and valuable booklet entitled "Taurus Bronze Castings." The bulletin contains a discussion on the art of bronze founding, information of value in the selection of bronze for engineering castings, and data on the following: Influence of composition on physical properties, centrifugal castings, raw materials, melting practice, casting temperature and cooling conditions, analysis of bronze, physical testing, purchasing bronze castings, and specifications of the various alloys. The bulletin is exceptionally well illustrated with tinted photographic reproductions.

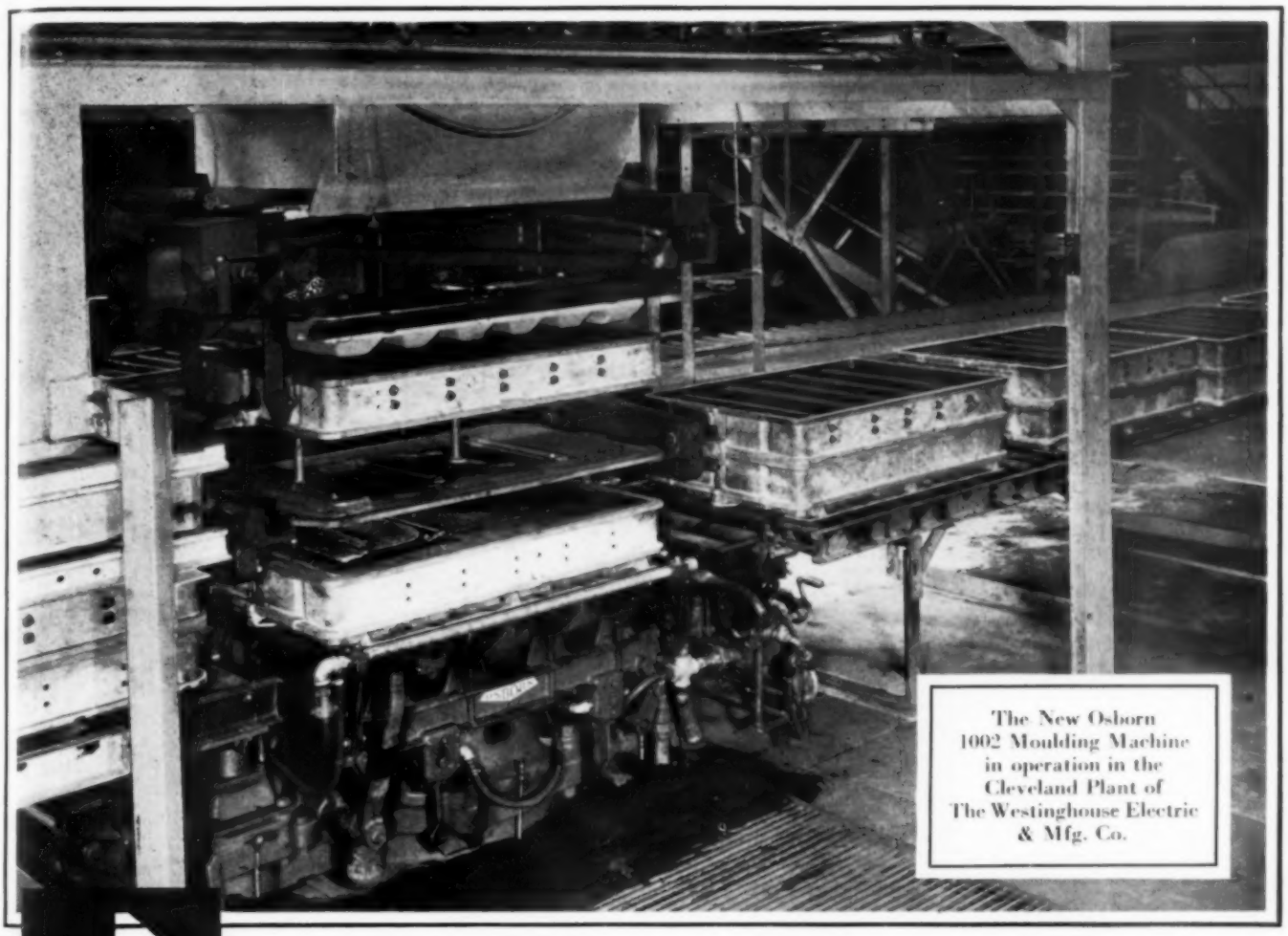
Book Review

A Textbook of Metallurgical Problems, by Allison Butts, cloth, 425 pages 6 x 9½ inches, published by the McGraw-Hill Book Co., and supplied by THE FOUNDRY, Cleveland, for $4 plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., 416-17 Caxton House, Westminster, London.

As indicated in the title, this work has been written primarily as a further aid in the teaching of metallurgy. It consists of many problems for solution, covering a variety of subjects, and explanatory material to provide the necessary background of fundamentals to permit solution. As the author points out, he has exercised extreme care in providing a balance for the two phases of the work so that the subject will be clear, but the solution of the problems involves more than the substitution of figures in formulas.

Chapters which will be of special interest to the foundryman include the following: Combustion, charge and product calculations in metallurgy of iron and steel, the heat balance, production of blast and draft, alloys, volatization of metals in melting, transmission of heat, etc.

To those familiar with *Metallurgical Calculations*, prepared in 1906-08 by Prof. Joseph W. Richards, the author points out that the present work supplements the earlier work. In general it continues the methods which had been introduced, extends further data in certain directions and provides new data necessary for accurate calculations. The student in metallurgy should find this work exceptionally helpful.



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Complete moulds are made from 28 x 42-inch match plate patterns. Every operation is fast moving. Large moulds are made in the same manner as ordinary squeezer moulds and in approximately the same time.

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The Adventures of Bill

BY PAT DWYER

DO YOU remember a story I told you a couple of months ago," Bill inquired the other night, "about an exceedingly ingenious English molder who raised the price of a few drinks by manipulating the pounds, shillings and pence in a manner that would have reflected credit on an experienced financier? In fact I doubt if the chancellor of the exchequer could have done a neater job in balancing the budget."

"You mean the lad who pawned his partner's breeches, then bought a clock on the installment plan, paid three shillings down, re-pawned the clock and so forth? Yes, I remember the story, but it seems to me there was a catch to the thing some place. I hope you are not thinking of trying the plan. You'll land in jail. Furthermore, young feller me lad if you are thinking of borrowing my pants for the experiment—"

"Keep your hair on—likewise your pants. I don't want 'em. I just wanted to tell you I had a letter today from a lad who read the story in THE FOUNDRY.

"Ah! Just so," I remarked with becoming modesty. "He must have been rather pleased with the story otherwise he would not have gone to the bother of writing you. Would it be violating any confidence to ask you what he wrote?"

"Well," said Bill, "I'll tell you. He did not comment on the merits of the story. Probably he had heard it before, told in the foundry vernacular, embellished with many sanguinary and picturesque expressions, banned from the ordinary printed page and found only in the higher and better works of fiction, the best sellers.

"He merely wrote that the story reminded him of another story current in the same locality, a big steel shop in Sheffield, England. He gave me the name of the principal character in the story, but since one name is good as another to you I shall call him big Jack Smith. That's a good roast beef of old England name and Jack, 6 foot 2 in his clogs and weighing about 14 stone without his waistcoat and neckerchief was a fine burly specimen of the hearts of oak.

"He distinguished himself on one occasion by chasing the gaffer all over the shop with an easing bar in his hand, because forsooth the aforesaid gaffer had made a slight technical error in guiding his cope past one of the stakes in the floor. A highly temperamental lad in anything touching on the technique of his craft."

"I've seen his prototype," I said, "in many places. Is that all the story?"

"Certainly not," Bill protested. "This lad who wrote me the letter was in no hurry. He did not learn his trade that way. This preliminary stuff corresponds to digging the pit, laying down the binders and coke bed and setting up the vent pipes. Fair and easy is the word. When everything is arranged to his liking he pours the job and not a minute before.

"In this particular instance he sketches briefly some of the habits and customs of the English molder at work and at play. He deprecates the introduction of this apparently irrelevant material, but claims that it is necessary. Without this explanation he doubted if I would see much point to the story.

"Molders working in the *big end* of the shop rarely report for duty on Saturday morning. This is due principally to the fact that since time out of mind—well, anyway since King John signed the Magna Charta at Runnymede—Saturday in the tight island has been observed as a half holiday. Exceptionally large castings usually are poured on Friday and the molders are kept busy for several hours *easing* the mold in various places to facilitate contraction and to prevent the casting from cracking.

"This part of the work is both hot and heavy. The creative spirit which actuates all true craftsmen hold them on the job despite the heat and the exhaustive muscular effort. The loyalty, the *esprit de corps*, the spirit of which heroes are made is cased in moleskin as often as it is in khaki.

"However, even heroes must rest occasionally and thus we find the men from the *big end* idle on Saturday morning. Molders in other parts of the shop work until noon. The idle men sleep an hour or two extra in

Lots of willing hands ready to give him a lift with the cope—or a glass

the morning, dawdle through a leisurely breakfast and then bravely decked out in their best clothes saunter up to the pay master's window at the shop about 11 a. m. to get their money.

"By a curious coincidence a philantropist had set up an establishment a short distance from the shop where thirsty molders might sluice the sand out of their pipes and cool off the crown sheet before going home. This noble pub was known as the Molder's Arms, a delicate tribute to the majority of its clientele. Instead of the saw dust found in the—at one time—American saloons of a like character, the floor of this haven of rest was covered with sand.

"For the benefit of American molders accustomed to the use of drags and bottom boards, it is pertinent to point out that in this shop where Big Jack worked, nearly all the jobs are bedded in the floor. With the shop running full handed, only an exceptionally clever molder could walk across the shop without stepping on the joint of a mold and thereby call down on his head the jeers and maledictions of the particular molder working on the job.

"Immediately after receiving their pay one Saturday morning, the big end gang hastened to this oasis in the desert to discuss some of the burning issues of the day. Three or four brimming beakers pretty well extinguished the burning issues and also introduced the only subject which molders consider worthy of discussion, any time or any place. Even the most taciturn and anchorite members of the craft—when flooded out of their shells—will defend their pet theories in the face of the most violent opposition from gentlemen who do not see eye to eye with them. In many instances they describe and illustrate with free hand sketches specific molds they made. The spoken word at best cannot compare with even a rough free hand sketch in the description of a large or intricate mold.

"Given the opportunity and the materials, a molder will draw a sketch with a pencil, a pen, a crayon or anything else that will leave a mark on paper, cardboard, the side of a flask or the oven door in the foundry. In the pub he will do the same on the bar or on a table top. Lacking other drawing equipment he will dip the point of his index finger in his pot of beer and use the moistened finger tip as a pen. Needless to say this deliberate waste of the precious fluid only is practiced late in the session when the first keen edge has been worn off and when the tankards are emptied and refilled more through habit than from necessity.

"The sanded floor of the Molders Arms provided Big Jack with a drafting board more to his liking. He was to start the mold for an immense hawse pipe on the following Monday. Naturally as a skilled molder he had all the details planned in his mind. He courteously bespoke the attention of his cronies and then dropped on his hands and knees to demonstrate the details in the sand.

"He had traced the outline of the pattern, indicated the position of the drawbacks and marked the limits of the joint when the quitting time whistle blew in the foundry. He was setting the runner pegs and the risers when the door burst open to admit the fleetest of the racers who had been working all morning. Before this thirsty lad, with parched tongue hanging out, could stop his headlong flight he was half way across the drawing on the floor. Jack jumped to his feet in a rage.

Bill's friends are great letter writers

" 'Look at him!' He yelled. 'The missbegotten spawn of a bandy legged farmer. He has the audacity to call himself a moulder and yet here he is dragging his big flat cloven hoofs all over me joint!'

"I readily can imagine," I said, "how that incident would appeal to the boys grouped around the artist on the floor. Also how the story traveling by grape vine telegraph would elicit chuckles among the mowlders from Land's End to John o'Groats. However, you would have a grand time trying to explain the humor to an outsider."

'Oh, well, " Bill said, "that is true of practically everything connected with the foundry. I had an inquiry some time ago from an official in a large foundry who admitted that he was neither a practical nor a technical man. He wrote that a mixture of 50 parts old heap sand, 5 parts burned core sand and 1 part fire clay had been recommended as superior to the facing sand prepared in the usual manner from a mixture of new and old sand. His men had tried this mixture with satisfactory results on special pipe and other castings weighing up to 300 pounds. The shop is equipped to handle castings up to 20 tons and he would appreciate my opinion on this experiment he was trying.

"The practice of adding clay mechanically to sand either new or old, is part of the regular routine in steel foundries and has been ever since the early steel founders abandoned the primitive mixtures containing pulverized brick bats and discarded crucibles. In recent years the practice has been introduced in foundries devoted to the production of gray iron and malleable iron castings.

"Reduced to a final analysis the problem is one of economic rather than one of practicability. Sand conforming to certain recognized standards will serve satisfactorily in molds irrespective of whether it is a natural or a synthetic product. The final cost of the sand over a given period, and this includes cost of supervision and preparation, is the deciding factor. Naturally these cost figures will show wide variations in different localities and in foundries producing small and large tonnages of castings of various classes.

"A comprehensive review of this subject in a series of six articles was published in THE FOUNDRY March 1 to May 15, 1926 under the title 'Can Used Sand Be Reclaimed?' A perusal of these articles will show that this is not a question amenable to a simple yes or no answer.

"The principal reason for adding new sand to a mixture is to renew the clay bond burned out in service. The new sand contains more bonding material than actually is required for molding purpose. Fire clay may be described as bonding material in concentrated form and therefore only to be added to old sand in comparatively small quantities. Adequate mechanical equipment plus close and intelligent supervision are required in the preparation of the synthetic product.

"Several factors must be considered in addition to the one involved in renewing the bond. Under ordinary conditions the new sand in the facing increases the bond and also compensates for the sand that is destroyed or lost as a result of coming into intimate contact with the castings.

"Considerable amount of experimenting will be required over an extended period to determine the correct amount of clay necessary to bond the sand properly and to compensate for the amount of sand lost each day. A man with neither technical or practical experience easily may be deceived by the apparent success of a few experiments."

The Foundry Through the Years

(*Concluded from Page* 19)

mechanical presentation was thrown to the winds in the April issue of 1896, and in large, bold face type, the largest type yet employed THE FOUNDRY proclaimed:

AT LAST
American Foundrymen to Have a National Association

The "meeting was a grand success in every way." The 345 foundrymen present founded the American Foundrymen's association, discussed technical and shop problems of the industry, had a good time, and elected the following officers:

President, Francis Schumann, Tacony, Philadelphia.

Vice presidents, New England States, F. W. Gibby, Boston; Middle States, Robert G. Taylor, Pittsburgh; Southern States, Henry Clay Evans, Chattanooga; Central Western States, John M. Sweeney, Chicago; Southwestern States, W. S. Mosher, Dallas; Pacific States, Irving Scott, San Francisco; Canada, Joseph Best, Montreal.

Secretary, John A. Penton, Detroit.

Treasurer, Howard Evans, Philadelphia.

During the three days of the convention, a Daily edition of THE FOUNDRY carried the news of the convention to those present, just as similar volumes of *The Daily Foundry* greeted convention visitors at Cleveland in 1923, Detroit in 1926, Philadelphia in 1928 and Cleveland again in 1930.

Study Cost Reduction

With business at a low point, foundrymen again turned their attention to the problem of reducing production costs through application of various types of equipment to materials handling problems, and numerous types of cranes, and a trolley system installed in a light castings shop, were described in the pages of THE FOUNDRY during 1897. The feature of the year, in respect to handling problems, was presented in a description of the foundry of the Westinghouse Air Brake Co., Wilmerding, Pa. This installation of equipment had a great many of the features found in the modern production foundry.

Molding machines were placed along a conveyor, the machines being worked in pairs; one on the cope and the other on the drag. Molds were lifted from the machine table and placed on the mold conveyor, which consisted of a number of platformed carriage, about 2 x 2½ feet, strung on an endless link belt which traveled around two 8 foot sprocket sheaves in an elongated ellipse 150 feet long by 10 feet wide. The outside wheel on the carriage was 12 inches in diameter and the inside 6 inches, and both operated on rails.

Molds in front of the machines were filled, a signal was given, and the conveyor was moved forward about 30 feet, so that the molds were in line with the core setters and finishers. Each movement of the conveyor brought the molds in the remaining sections devoted to closing and clamping, pouring, cooling and shakeout in the order named. Flasks were handled by crane at the shakeout, and were returned to the molding stations on the conveyor. Sand was prepared for use near the shakeout, carried by a bucket elevator to a conveyor which carried it to bins over the molding machines and the operator placed sand in the mold simply by pulling a lever at the end of the discharge chute.

Principles Differ Little

Certainly the principles employed then differ little from those in use today, although remarkable progress has been made in the perfection of the equipment utilized in the process.

The second annual convention of the American Foundrymen's association was held in Detroit in May, and an "exhibit of foundry appliances was among the novel features." On July 31 of that year, the Pittsburgh Foundrymen's association was formed.

Activity during 1898 inclined slightly toward the metallurgical phases of the casting business, and numerous articles appeared covering such subjects as the microstructure of iron and steel, necessity of well mixed furnace casts and correct pig iron analysis, manganese in cast iron, metallurgy of a malleable iron, etc. The first article by Charles Vickers, in which he discussed brass foundry problems, appeared in the September issue and the record of Seth Boyden's experiments on malleable cast iron was presented in the last issue of the year. The third annual convention of the American Foundrymen's association took place in June at Cincinnati. Pittsburgh was voted the 1899 meeting.

The new year opened auspiciously for business in general, and "the steady expansion of the trade that marked the closing weeks of 1898 inspired everybody with confidence in a prosperous opening of the new year, but **** few were prepared for the stupendous demand for products of industry that now exists." In May THE FOUNDRY said editorially "There never was a time when the demand for foundry products so far exceeded the possible supply as at the present." Such was the call for castings that the whole producing capacity of the country was taxed to the utmost to supply material already contracted for and new orders were taken with much reluctance. Prices increased materially.

Thus the Gay Nineties, that period in which THE FOUNDRY was born and in which it grew rapidly in stature and influence, came to a fitting close. On the morrow would dawn the Twentieth Century, with its machines, mass production, automobiles, wars, booms and depressions. History again would repeat itself.

F. G. S.

Malleable Club Meets in Milwaukee

Several talks were made at the first regular meeting of the fall season of the Malleable club, held at Hotel Blatz, Milwaukee, Sept. 13. V. F. Gapinski, superintendent, Milwaukee Malleable & Grey Iron Works, Milwaukee, presented the report calling attention to items of interest that had appeared in recent issues of technical magazines. Favorable comment followed his reference to the co-operative work undertaken by the Malleable Iron Research institute with universities and technical schools.

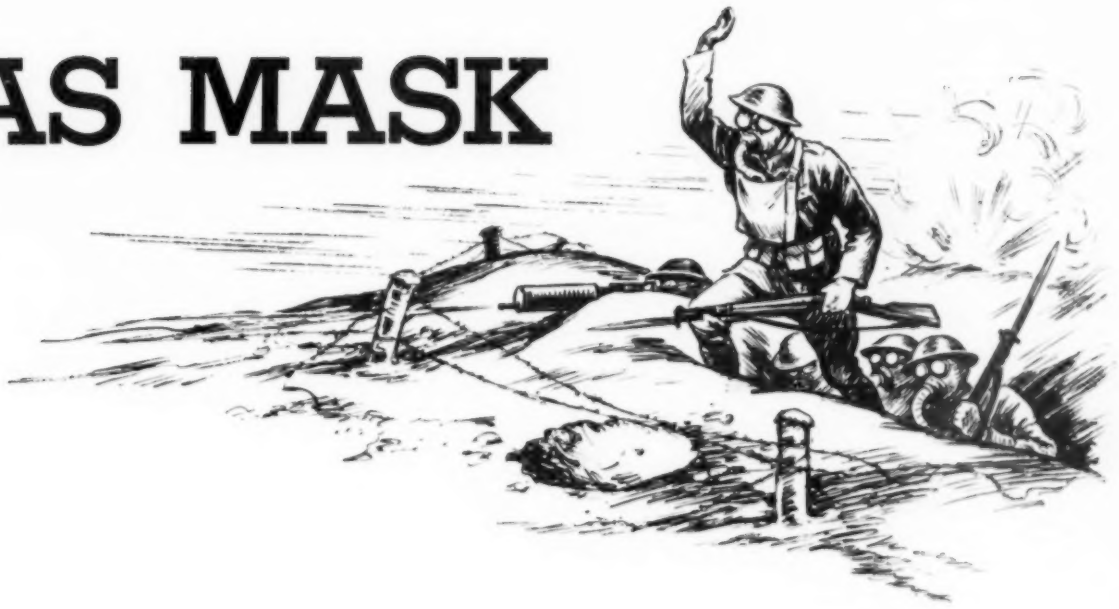
J. H. Hill, Glancy Malleable Corp., Waukesha, Wis., presented a summary prepared from estimates based on blueprints made by members of the club during the year. This excellent summary provided a basis for checking achievement and stimulated a lively discussion.

B. K. Gapinski, Milwaukee Malleable & Grey Iron Works, Milwaukee, lead the discussion of estimates made by members from a blueprint of a casting provided by his company. Twenty-five members were present.

To Consider Studies In Steel Research

Reports on studies in steel research, undertaken by the Carnegie Institute of Technology, Pittsburgh, will be discussed Oct. 28 at the sixth annual meeting of the metallurgical advisory board of that institution. The morning session will be devoted to reports on studies made by the bureau of metallurgical research at Carnegie Tech on the alloys of iron, manganese and carbon. The afternoon session will consider the work of Dr. C. H. Herty Jr.

GAS MASK



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Do Lawsuits Levy Tribute?

(*Concluded from page* 24)

prevention of silicosis will be left to the medical profession. The correction of the situation, from a legal standpoint, is in the hands of the state legislatures.

The only way the legal situation can be corrected is by proper legislation, and the burden is on industry to see to it that proper bills are placed before the various state legislatures and that they are enacted into laws. It will be necessary first, that silicosis and kindred sicknesses are taken out of common law and put clearly within the jurisdiction of the industrial commissions of the various states.

Many Benefits Derived

There are many benefits to be derived from placing silicosis under the workmen's compensation acts. There is a limitation as to the amount to be recovered. In practically all the workmen's compensation acts throughout the country, the defendant or respondent has a right to have the claimant examined by competent doctors at any time before a hearing. This right does not inure to the defendants in most states in the common law courts. The payment under the workmen's compensation act is made on the instalment plan and not in a lump sum. If a claimant is a malingerer, and, with the assistance of exaggerating expert doctors, he is able to obtain a large award, this award is paid on the instalment plan; and should the claimant's actions and movements subsequent to the hearing develop the fact that he is not disabled to such an extent as the award indicates, the defendant or respondent can file a petition before the industrial commission to have the ward cut down and corrected. The petition can be followed up by producing proper evidence to establish the facts. When times are normal even a malingerer gets tired of malingering and goes to work at some occupation that will pay him more money than the small weekly allowance derived from compensation payments.

As the workmen's compensation acts of the various states now stand, the foregoing are some of the many benefits that will inure to industry by placing silicosis completely under workmen's compensation. The first step, therefore, would be to take silicosis claims and suits away from the juries and out of the common law until such a time as proper enactments within the scope of workmen's compensation acts can be made to apply more specifically to silicosis.

Our legislatures have had very little experience with silicosis, but the lawmakers of several other countries have—particularly the British in South Africa. And Canada has its silicosis laws. These laws are based upon experience and statistics and, in many ways, are not perfect. For example, in Canada it is necessary to prove three years of exposure before a claimant can recover. Doctors will agree that it is all a question of degree and also susceptibility. The length of exposure cannot well be figured out by a yardstick. It will, therefore, be well in framing future legislation to procure enactments on the situation from various states and countries throughout the world and also to assemble medical data. It is a simple matter from a medical standpoint to estimate specific loss of use of any of the members of the human body, but considerable difficulty is encountered sometimes in estimating the damage done by an injury to the spine, and in the case of silicosis it is extremely difficult to figure accurately the loss which has been suffered by particular individuals. Doctors will agree that silicosis affects different people in different ways, but before it is possible to figure percentages of disability in a manner that even approaches accuracy, it will be necessary for doctors specializing in this and similar diseases to spend considerable time and study on the situation.

Explains Time Limit

Under injury claims of various kinds the time limit within which one may file a claim or suit dates from the time of the occurrence or happening. In the case of silicosis there is in fact no single happening, and medical men state that silicosis sometimes occurs many years after exposure. It would appear, therefore, that some thought and consideration will have to be given to the time limit within which claims may be filed. The time limit is referred to by lawyers as the statute of limitations. Another question that will arise in specific legislation on this subject is the question of exposure of one individual to the hazard in several different plants. Medical men will undoubtedly agree that it is impossible to determine to any extent the percentage of silicosis received during several different exposures, varying in length of time and intensity of exposure. These last thoughts are merely to indicate that it will be necessary to have the careful, joint consideration of capable lawyers and experienced doctors on these diseases before proper legislation can be enacted. It will not do to have any haphazard legislation, as the matter is so far-reaching that the results may be vastly harmful.

Cast Iron Found In Old Rochester Arcade

In razing the Reynolds Arcade at Rochester, N. Y., recently, several interesting applications of cast and wrought iron were found. Whether that material was incorporated in the building at the time it was erected in 1828, or was included in subsequent reconstruction, is not known.

The entire skylight was found to be cast iron trusses with wrought iron tie rods. On the front of the structure were cast iron supports cast in shapes similar to the iron levels used by present day mechanics. There also were a number of cast iron columns.

The structure also contained many hand hewn beams of unusual size and in good preservation, some being 40 feet long, spliced lap step style and held with heavy hickory pins as firmly as 105 years ago. The grain was placed to stand the heaviest strain.

In this arcade, now being supplanted by a new one, was born the Western Union Telegraph Co., according to J. R. VanInwagen, commercial agent. The Western Union company was the oldest and largest tenant. Indians tore down the first lines.

George Selden, of automobile fame, once was a tenant. The first Bausch & Lomb factory was in the old arcade. It was there that Thomas Edison made his first successful experiment with the quadruplex telegraph.

A half ton of iron was listed among the effects of Abelard Reynolds, the builder, when he migrated from New England to Rochester, then called Rochesterville, in 1812.

Melts Iron In 21 Inch Cupola

(*Concluded from page* 17)

After six charges have been introduced, the coke is reduced to 25 pounds.

This cupola is melting regular gray iron, semisteel or high test iron with a steel content of 30 to 80 per cent, special mixtures such as 96 per cent steel and 4 per cent alloys as well as other commercial iron alloys.

The height of the cupola, 84 inches, may appear to the reader to be insufficient, since the formula of twice the diameter plus 5 feet would give a theoretical figure of 102 inches. Nevertheless, it has been possible to obtain regularly a temperature of 2800 degrees Fahr. and higher.

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International Congress

(*Continued from Page* 16)

gations relating to additions of silicon to cupro-nickels. J. Laissus contributed a paper on "Metallic Cementation and Its Recent Progress," in which he shows cementation treatment can be applied, not only to diffuse carbon in steel, but also to diffuse chrome, molybdenum, zinc, etc., in various metallurgical products. This is of great interest for decorative and protective purposes.

C. H. Meigh spoke on "Rational Use of Aluminum Bronze by the Study of Solidification, Dressing and Internal Stresses." Consideration of these factors in designing a casting permits maximum qualities of aluminum-bronze alloys from the standpoint of homegeneity, high mechanical properties and reduction of thicknesses with corresponding reduction in weight. "Precious Alloys of Gold, Silver and Nickel" was the title of a contribution by F. Renaud.

Discuss Light Alloys

The section on aluminum and light alloys included the exchange paper of the American Foundrymen's association, "Some Practical Foundry Considerations for Improving the Soundness of Aluminum-Alloy Castings," by H. J. Rowe and E. M. Gingerich, Aluminum Co. of America, Cleveland. The paper was read in abstract by Vincent Delport. In the discussion R. deFleury suggested the common adoption of certain terms qualifying action of factors of porosity, which would give more precision to study of the subject. L. Montupet, who presided over the session, laid stress on importance of co-operation between engineer and founder, which the authors had themselves emphasized.

Exchange paper of the Institute of British Foundrymen on "Some Causes of Defects in Aluminum-Alloys" was by Prof. C. E. Hanson, University of Birmingham. The paper deals with absorption of gases, effects of these absorptions, and various methods proposed for decreasing defects due to gases. The latter include treatment of metal before pouring, and control of conditions of melting and pouring. R. de Fleury presented a paper entitled "Technical Factors of Instability Applying Especially to Over-Specialized Foundries." An Italian paper on "Electric Furnaces or Fuel Furnaces?" was contributed by Dr. Carlo Sonnino. For the melting of aluminum and its alloys, the author states that numerous technical advantages of electric furnace more than balance slight economic advantage of fuel furnaces. A paper "Resistance to Fatigue of Some Aluminum Foundry Alloys," by R. Cazaud gives results of tests effected in laboratories of aeronautical research service.

A special section was devoted to questions of general interest, and included an exchange paper by the Czech association: "Bonded Sands for Cores" by J. Duskocil. After dealing with the grades, chemical composition, grain size, resistance to heat of sands, the paper gives information on oils, varnishes, glutrine, molasses, starch and various other bonding materials. Necessity for careful control is emphasized.

Exchange paper of the Association Technique de Fonderie de Belgique was by J. Varlet: "Contribution to the Study of Expansion in Sand Molds and Cores." Certain cores appear to lengthen during pouring, with detrimental results. The paper describes laboratory experiments which throw light upon the subject. "Some Special Cores," a contribution by H. Fabre, gives methods of preparing certain cores used occasionally in heavy and medium-size castings. L. Maillard presented a paper on "Hydraulic Bonds in Foundry Practice," describing a new method of preparing molds with pure siliceous sand and cement. These molds can be prepared without flasks; and a description of the steel foundry of Societe des Acieries Electriques d'Ugine, where the method was invented and developed, will be given in a subsequent number of THE FOUNDRY.

Suggests Bending Tests

Mr. Guillemeau contributed: "Some Remarks on the Static Bending Tests of Cast-Iron"; stating the measure of deflection at breaking point of the test-piece in the Fremont test does not always give the result required by specifications, even with high-quality iron. He suggests measuring the difference between deflection under stress of 400 and 100 kilograms. Polish foundry association exchange paper: "Filling Molds and Calculation of Gates and Runners," by T. Miaskowski, gives a number of formulas and tables for different shapes and sizes of runners, for different castings, and for different aluminum-alloys are given.

One section was devoted to papers on steel and malleable cast-iron. P. L. Tagliaferri, Genoa, Italy, spoke on "Comparative Study of the Cost of Remelting Cast-Iron in the Cupola and in the Electric Furnace." Conclusions are in favor of replacement of the cupola by the electric arc furnace; but it should be noted that the data referred to applies especially to conditions in Italy. M. Roger contributed a paper "Remarks on the Quality and Elaboration of Metal for Steel Castings in the Basic Open-Hearth Furnace." The author indicates the qualities which metal should have to ensure sound castings. He reviews the conditions of operation of the basic open-hearth furnace from choice of raw materials to pouring in the ladle, and refers to the necessity of close control.

"Contribution to the Study of American Heat-Treated Malleable" was the title of a paper by M. Leroyer. L. Thierry presents results of investigations on additions of nickel to malleable iron in "Malleable Iron with Nickel and Nickel-Chromium Additions," in which he shows that nickel gives a finer graphite grain, while chromium retards graphitization. Nickel and chromium together give a graphite and carbide structure on a fine pearlitic ground.

Study Graphitization

A. Le Thomas and E. Morlet presented a paper entitled "Slow Graphitization at Moderate Temperatures," in which the graphitization of an iron used for turbines, diesel engines, etc., is studied in relation to the time factor. Total carbon was 3.50 per cent, silicon 1.57 per cent, manganese 0.71 per cent, sulphur 0.10 per cent, phosphorus 0.56 per cent. Another paper by A. Le Thomas and Renee Le Romancer was: "Influence of the Reheating Temperature on the Form of Precipitated Graphite." It is shown that under 900 degrees Cent. graphite takes the form of nodulae, and that of lamellae above 1000 degrees; it is necessary to be careful of using accelerated methods of graphitization at temperatures above 1000 degrees.

The seventh section was devoted to various questions. One paper on "The Study of a Core Box" was contributed by R. Biry. Another contribution, by F. Simorre, was on "The Manufacture of a 7-Ton Rectangular Vat, in Acid-Resisting Cast-Iron, with the Application of Simplified Methods for Mass Production." F. Renaud was the author of "Problems Concerned with the Safeguarding and the Development of the Use of Castings," which emphasizes the danger of competition from pressed or stamped steel, forged pieces, welded pieces, and plastics, and shows means by which such competition should be met. The last paper of this section was: "Autogenous Welding and the Foundry," by R. Granjon. While admitting the danger of competition between welding and casting, the author shows how the two industries should cooperate.

The last section dealt with cast-iron testing methods. The first

paper, "Methods of Testing Cast-Iron," contains results of investigations made by the scientific committee of the Association Technique de Fonderie de Belgique along the lines indicated by Dr. Meyersberg, Berlin. Tables give results of numerous tests. A. Le Thomas, in the discussion, stressed importance of the work, and said that Dr. Meyersberg, in inviting foreign associations to collaborate, had given a great example of international co-operation. Guy Henon presented a paper entitled "Contribution to the Study of the Machining of Cast-Iron." After reviewing the various methods of testing used at present, the author explains an industrial method by comparing the mean advances of a drill under constant pressure and speed on a piece of the cast-iron to be tested and on a standard test-piece. This method is somewhat similar to the Mei test, but differs in certain particulars.

Two important papers: "Contribution to the Study of the Destruction of Cast-Irons by Acids" and "Contribution to the Study of the Desulphurization of Cast-Iron and of the Action of Sodium Carbonate on Iron During Melting" were by F. C. Girardet and Tsou-Ren-Kou and by F. C. Girardet and R. Lelievre respectively. The first paper shows corrosion by acids is caused by elementary voltaic couples between various elements of the iron, and can be avoided by a fine structure of the iron. In the second paper, beneficial effects of desulphurization by sodium carbonate in a fore-hearth animated with an eccentric circular movement are shown. In the discussion, L. Piedboeuf, Belgium, pointed out that desulphurization is accompanied by deoxidation.

Hold Joint Meeting

J. M. Espana, president, international committee on the foundry dictonary, communicated results of the work effected to date. He suggested that a committee should be formed in each country to define its own foundry terms, and that the work should be centralized by the international committee.

Many attended the joint meeting of the congress with members of the Societe des Ingenieurs Civils de France, in the building of that society, with Prof. A. Portevin, president of the society, in the chair. Three lectures were given at this meeting. The first paper, by R. Lemoine, professor, School of Foundry, was entitled "Application of Acid Electric Furnaces in the Steel Foundry," and shows the electric furnace with acid lining can be used advantageously in steel foundries for small or medium castings which work in conjunction with basic open-hearth steelworks, or in a foundry connected with a shop utilizing laminated open-hearth steel, or, again, in a foundry that can economically obtain steel scrap.

The second by Leon Guillet and Mr. Ballay, was entitled "Special Cast-Irons" and covers a large range of irons, including those hardened by the nitriding process, heat-resisting irons, corrosion-resisting irons, magnetic irons, etc. The third paper was "Contribution to the Study of Low-Carbon Cast-Irons," by H. Portier. Influence of various contents of silicon and manganese in an iron with 2.5 to 2.6 per cent total carbon are studied in the pearlitic range for a given speed of cooling. Properties and advantages of low-carbon irons in comparison with high-duty irons used in industry are given.

Three lectures also were delivered at the closing meeting of the congress, held at the invitation of the Comite des Forges. The first, by Prof. Portevin, was entitled "Present State of the Study of Castability (Coulabilite) in Metals and Alloys." The conclusions show that the measurement of castability in the spiral test mold can be of considerable use: (a) to choose alloys that best fill the mold and with a wide margin of pouring; (b) to control pouring temperature for a given alloy; (c) to show and control alterations in a metal; (d) to facilitate choice of materials for molds, and temperature of molds.

J. Durand and J. Vernay delivered the second paper, entitled "Contribution to the Study of the Life of Steel Ingot Molds." It shows that by using special irons with 0.5 per cent of chromium and 0.5 per cent of nickel, the life of ingot molds can be increased by 21.8 per cent. The last paper, "The Production of High-Duty Cast-Irons by Superheating and Refining in the Induction Furnace with Normal Frequency," by A. Levasseur, and shows that for foundries with a regular production, the induction furnace with magnetic core and normal frequency presents certain economic advantages.

Examining Driver Applicants Reveals Physical and Mental Fitness

PROPER selection of truck drivers presents numerous problems which require close attention, as was explained in an article on page 56 of the August issue of THE FOUNDRY. Preparation of a satisfactory application form, interviews with a favorable report on the applicant's qualifications, and recommendations by references, particularly the last employer, should be considered only preliminaries. Not until these things have been done, however, is it justifiable to take time and expense for testing an applicant to determine his physical and mental fitness and his ability to drive.

Order in which the tests are made will be dictated by convenience, but if there is no preference the least expensive should come first. Generally that means the driving test. Even the smallest organization can afford the road test and no driver should be hired without it. If some emergency seems to make it necessary he should be on probation until he has passed such a test.

Value of the test will depend on ability of the tester and thoroughness of the procedure. It should be made in a vehicle of the same type that the applicant will be expected to drive. If he happens to be unfamiliar with that type he should be made acquainted with its operation before starting the test. Where there is a drivers' foreman he is usually the one to make the test, otherwise one of the most skilled drivers should be selected for the job.

It is best to have a form for the observer to fill out. A comprehensive one is given in safe practices pamphlet D-2 published by the National Safety council. Unless the tester is an expert and makes tests frequently, at least he should carry a list of points to be observed. Commercial vehicle operators of New York suggest the following list:

1. Observance of local traffic regulations.
2. Observance of common sense rules.
3. Attitude toward other drivers.
4. Attention to driving.
5. Attention of pedestrians.
6. Manner of overtaking vehicles, including street cars and manner of being overtaken.
7. Manner of making left and right turns.
8. Use of signals.
9. Manner of stopping.
10. Manner of approaching railroad crossings.
11. Observance of traffic signs.
12. Manner of backing and backing to turn.
13. Manner of running with traffic.
14. Manner of riding hills.
15. Manner of parking.
16. General speed.
17. Manner of starting and shifting gears.

The physical examination should be made by a doctor, if possible, and he should know that the man is being considered for a driver's position. A written report of this examination should be filed. The men-

tal test should include an intelligence test of a kind to disclose mental alertness rather than extent of schooling. Ability to read is essential to proper understanding of traffic signs, traffic regulations and company instructions. Accuracy in filling out forms and answering questions should be noticed. Particularly important is the speed of the applicant's mental reaction as observed by timing his response when asked questions and noting how quickly he can carry out a series of suddenly suggestion actions and whether he performs them in the right order without confusion. Good judgment and prompt action are potent accident preventives, so some of the test questions should ask what a driver would do in various emergencies.

As part of the mental test the prospect should be studied for what is called his social attitude. This is best described as his disposition and is one of the hardest things to judge because he will be on his good behavior while under examination. What this study attempts to reveal is how the man as a driver will be inclined to treat others. Whatever his other qualifications, a company cannot afford to hire a man who has evident potentialities for hurting the firm's business by offending customers.

Steel Founders Report Pickup In Orders and Inquiries for Castings

INQUIRIES and orders for steel castings have increased slightly, according to reports made by individual members at the meeting of the Steel Founders' Society of America, Inc., held at Pittsburgh on Sept. 14. Exhaustion of supplies in most lines of business was the primary reason advanced for the gain in business. A definite trend toward higher prices for steel castings also was indicated and numerous foundries are marking orders "good for thirty days only."

Arthur Simonson, Falk Corp., Milwaukee, and president of the society, presided, and spoke briefly on the present business situation as it relates to the steel foundry industry. Mr. Simonson's remarks are presented on page 25 of this issue. Granville P. Rogers, managing director of the society, presented a report on the work of that organization.

Stipulation that roads constructed with funds borrowed from the Reconstruction Finance Corp. be built with hand labor and not with road building machinery, was cited by Frank D. Glosser, Commercial Steel Casting Co., Marion, O., and was discussed by practically every member present. It was pointed out that the ruling placed a great handicap on road contractors in meeting specifications, as uniform concrete thickness, etc., are dependent upon the precision of machinery.

Such a proviso not alone would affect millions of dollars' worth of machinery now in use, but would seriously injure manufacturers of such equipment. Furthermore, it would reduce employment in the plants building such machinery. It was felt that the rule making hand labor obligatory should be changed.

The board of directors of the society authorized the preparation of a brief on government competition with commercial steel foundries, which will be presented to the special investigating committee appointed by the house of representatives. H. J. Koch, Fort Pitt Steel Castings Co., Pittsburgh, called attention to the nation wide movement toward general rehabilitation of plants.

L. W. Lyons, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., speaking at the luncheon, stated the outlook for a revival in business is better than for a long time. He pointed out that manufacturers and business men now are a unit in the belief that the depression has reached the turn.

The annual meeting of the society will be held in Detroit the week of Jan. 16, 1933.

International Committee Meets in Paris

At the meeting of the International Committee of Foundry Technical Associations in Paris on Sept. 17, on the occasion of the Fourth International Foundry congress, the following delegates were present: A. Harley, past-president of the Institute of British Foundrymen, president; A. Damour, past-president of the Association Technique de Fonderie, immediate past-president. For Belgium; J. Leonard, president, Association Technique de Fonderie de Belgique; R. Deprez, secretary, Association Technique de Fonderie de Belgique. For Czechoslovakia; Dr. Fr. Mont. Pisek, president, Czech association; E. Rynda. For Spain; J. M. Espana. For France; E. V. Ronceray, president, Association Technique de Fonderie; Ch. Koehler, vice-president, Association Technique de Fonderie. For Germany; Dr. Geilenkirchen, director, German association; Dr. Humperdinck. For Great Britain: J. Cameron and V. C. Faulkner, past-presidents, of British Foundrymen. For Holland; M. Maas Geesteranus, vice-president, Dutch association. For Italy; Commandatore Jarrach and Dr. Guido Vanzetti. For Poland; M. Z. Lenartowicz. For the United States: R. S. MacPherran, delegate of the American Foundrymen's association to the congress; Vincent Delport, European delegate of the A.F.A.

After reading the minutes and passing the accounts for the financial year, a resolution, proposed by Vincent Delport on behalf of the American Foundrymen's association, and embodying a scheme of regulation of exchange papers, was passed unanimously. The scheme provides for the presentation of exchange papers at the international foundry congresses held each year in Europe, as well as to the world congresses held occasionally in Europe and in the United States. Questions of detail relating to the presentation of these were settled, and will also apply to papers which may be exchanged at the smaller conventions.

J. M. Espana, president of the dictionary committee, reported progress, and a method of work for the coming year was decided upon. Any contributions are to be addressed to J. M. Espana, c/o Association Technique de Fonderie, 44, Rue de Rennes, Paris (VI), France.

A proposal by the Institute of British Foundrymen to facilitate the exchange of foundry students between different countries was adopted in principle and referred for closer consideration at the next meeting.

Applications by countries wishing to hold the congress in 1937 were requested to be sent in, in time for consideration at the next meeting of the committee.

The following resolution, proposed by the French association, was adopted unanimously:

"In order to preserve continuity, the retiring president of the International Committee of Foundry Technical Associations shall be a member of the International Committee during the year which follows that in which he was president."

The election of the president and vice president of the International Committee for the year 1933 followed. Holland was designated to name the president, and Prof. Pisek was elected vice president.

Prof. Pisek then issued a formal invitation to hold the next international congress (Congress C) at Prague, Czechoslovakia, in September, 1933, and it was decided that the next meeting of the International Committee should be held at Prague on that occasion.

Manufacturing, engineering, sales and service facilities of the meter division, Worthington Pump & Machinery Corp., Harrison, N. J., and the Gamon Meter Co., Newark, N. J., will be used jointly according to a recent arrangement. George H. Gleeson will be in charge of meter sales activities of both companies.

FOUNDRY EQUIPMENT

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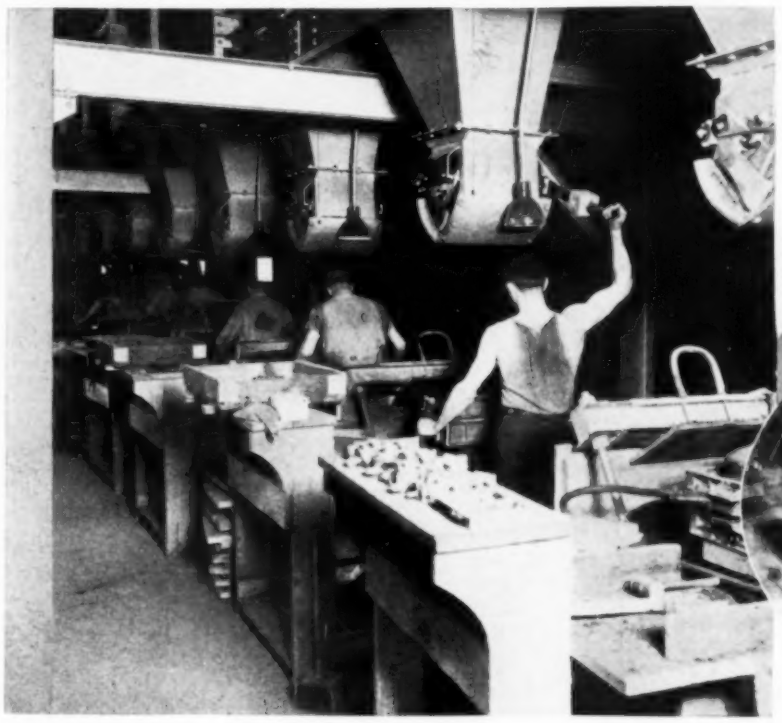

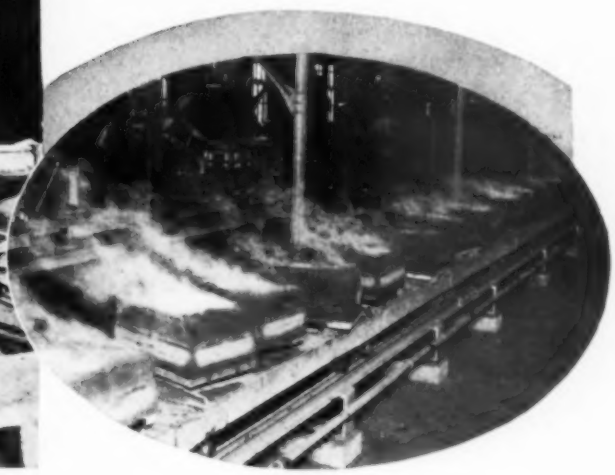

Lower Prices *Must* be Met With Lower Costs

After every lull in business, the big rewards in growth and profits go to those who have taken the opportunity to prepare for the approaching period of business activity.

Today, with casting prices at low levels, foundries should heed this lesson. Business increases will come . . . and profits will have to be made at these lower price levels. For the foundry that faces these facts, there can be but one conclusion . . . castings must be produced at lower costs.

The way to lower costs is not the same in every foundry. But there are certain operations, common to all foundries, where up-to-date methods mean sure savings.

Take material handling operations, for instance. Under old-fashioned, manual methods they are responsible for the major share of total foundry costs. Yet in this field, modern handling equipment, engineered by Bartlett & Snow, has proved itself capable of establishing materially lower costs in foundries of every type. Continuous mold conveyors, mechanical sand handling and conditioning equipment or simple conveyors for handling molds and castings . . . one or all of these may be the answer to your cost problem.

Decide now to learn what savings Bartlett & Snow equipment can show in *your* foundry. Write for information.

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Where Is Industry Headed?

(*Concluded from page* 25)

as has that of most other associations, and as is customary in bad times, there is a growing tendency to blame the association for conditions that exist instead of realizing that but for the society, conditions might have been infinitely worse.

There is no substitute for sound thinking, accurate estimating and good salesmanship up to the present time, and we shall have to depend upon our industry coming to its senses along those lines. Let us have the courage to quote a price and stick to it. I am sure that we will all be able to get our proportionate share of what business there may be on this basis.

A vagrant thought has been passing through my mind for some time and that is that the price of steel castings is not subject to the full operation of the law of supply and demand. There is no supply of steel castings in the ordinary sense of the word. With certain commodities such as things that grow, things that are produced from mines and oil wells, there is an actual physical supply, generally a surplus on hand, and if there is a reduction in demand there is an increasing inventory which overhangs the market and must be turned into cash, thus depressing the price.

Not Produced Until Ordered

A steel casting never is produced until it is ordered and, therefore, it seems to be logical that it should be priced on the basis of what it costs to produce it at the time it is ordered. The price of steel castings cannot be depressed by inventories overhanging the market and clamoring to be turned into cash at any price. It is depressed by the ignorance of those who do not know their cost, and by the desire of some to corral more than their proportionate share of the market.

Something can be done with the first for, except in rare cases of extreme stupidity, it is possible to educate the merely ignorant. But in the case of the second, he is just a marauding fool, impervious to an argument as plain as the nose on his face. No man has yet succeeded in increasing his output of steel castings for the reason, earlier stated, that you cannot induce a demand by making lower prices.

There is, at a given time, only a certain amount of business to be had and it is fairly well distributed on the basis of geographical location, friendship, previous business connections, quality, service and price. He who takes your business away on price has a momentary advantage, but you presently take away some of his and shortly you both have the same amount of business as before, and both at lower prices.

Exhibits Cast Iron Objects of Ancient China

Cast iron objects, claimed to be the oldest existing anywhere in the world, have been placed on exhibition in the Chinese archaeological collections at Field Museum of Natural History, Chicago, according to an announcement of Stephen C. Simms, director of the museum. The antiquity of the material has been established by Dr. Berthold Laufer, curator of anthropology.

Cast iron bell 20 inches high cast by the Chinese in the Eleventh century

The collection includes a large cast iron stove, vase, cooking utensils, lamps, an ink-palette, a bell, knives, swords, chisels, axes, hoes, chariot fittings, and various objects used as burial offerings. The material ranges in date from A.D. 25 to 220, which was the period of the later Han dynasty.

According to Dr. Laufer, iron as a metal was known to the Chinese long before the seventh century B.C., but how far back its use began has not been ascertained. From the seventh century B.C. onward records mentioning iron implements, chiefly for agricultural purposes, increase. Under the earlier Han dynasty (206 B.C.—A.D. 23) weapons gradually were made of iron although those of bronze still persisted.

During the first centuries of the Christian era in the western world, the triumph of iron was definitely established in China, and at the end of the later Han dynasty had ceased to be used for weapons and implements. In 119 B.C. under the reign of the emperor Wu, iron, like salt, was made a state monopoly. Iron founders amassed large fortunes. Severe punishments were meted out to those who secretly cast iron utensils.

Dr. Laufer points out that while the casting of iron was unknown to the ancient Greeks and Romans, the Chinese melted iron and cast it in sand molds, applying the same process they had used with bronze. They manufactured not only utilitarian objects from it, but also mortuary objects for placing in graves. The latter bear religious inscriptions, indicating that iron was regarded as a precious substance, valuable and durable enough to supersede bronze and pottery for the dead as well as the living. The accompanying illustration shows a Chinese bell of the eleventh century.

Book Review

Principles of Marketing, by Harold H. Maynard, Walker C. Widler, and Theodore N. Beckman, cloth, 790 pages 5 x 8 inches, published by the Ronald Press Co., and supplied by THE FOUNDRY, Cleveland, for $4.50, plus 15 cents postage; and in Europe by the Penton Publishing Co., Ltd., Caxton house, Westminster, London.

With the factor of selling occupying a leading position among the problems confronting business and industry today, this volume, prepared primarily as a text book for university students, should find wide appeal among others interested in marketing. Since the publication of the first edition in 1927, numerous changes have taken place in certain phases of marketing problems, so that the present revised edition contains much additional information as well as many refinements in presentation to effect greater simplicity and clarity of expression.

The book is divided logically into five sections, with the first part devoted to a general discussion of marketing fundamentals, including information on marketing functions and channels, bases and kinds of sale, buying motive of ultimate consumers and factors effecting consumption.

The second part on marketing institutions includes, in addition to a discussion of retail institutions, wholesale institutions, and co-operative marketing institutions, a discussion of industrial marketing.

The third section relates to marketing functions, including selling, buying, transportation, storage, finance risk, etc. The subject of prices is developed in the fourth section devoted to marketing policies, and "Cost and Efficiency" is the title of the last section of the book. The authors have included much illustrative material.

STANDARD
There are no compound grains in Ottawa Sand
The grains are not only free from dust, but are so hard and durable that they can be re-used effectively many times.
FREE FLOWING! QUICK CLEANING!
Black Hawk Blast Sand gives maximum effective cleaning at low air cost.
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Obituary

THOMAS F. McDONALD, formerly president and general manager, Dayton Brass Castings Co., Dayton, O., died recently. Mr. McDonald was born in Ireland and came to this country with his parents when he was 5 years old. They settled in Cincinnati, but in 1905 moved to Dayton where Mr. McDonald was employed at the Platt Iron Works. In 1908 he organized the Dayton Brass Castings Co. and continued as head of that company until he retired three years ago.

J. M. Stillwell, 54, for many years operator of the Donoho Foundry Co., Anniston, Ala., died August 25.

John S. Murray, 56, purchasing director of the Aluminum Co. of America, Pittsburgh, died at Pittsburgh, Sept. 13.

Richard D. Purcell, 59, treasurer and director, Ingersoll-Rand Co., and the A. S. Cameron Steam Pump Works, died Sept. 20 in New York.

August Mainz, 58 foreman of the Atlas Foundry Co., Detroit, for the past twenty years, died suddenly of a paralytic stroke while at work on September 26.

Robert Smith, 80, died recently in Mobile, Ala., where he had conducted a small novelty foundry since his retirement under the age limit from the navy yard at Pensacola, Fla.

John K. Moffat, 71, son of the founder of Moffats Ltd., stove manufacturer. Weston, Ont., and later president of that company, retiring two years ago, died at Weston, Sept. 8.

Merle A. Mesta of the family prominent in the Mesta Machine Co., Pittsburgh, manufacturer of rolling mill equipment, and himself identified with the Mesta company's engineering department from 1916 to 1931, died at Atlantic City, N. J., Aug. 28.

William H. Kleppinger, 49, president Calumet Foundry & Machine Co., East Chicago, Ind., died in Chicago, Sept. 12. Mr. Kleppinger founded the company 15 years ago. He was active in civic affairs, and formerly was president of the East Chicago chamber of commerce.

Edgar O. Webb, vice president, Brainerd Foundry Co., Brainerd, Minn., died recently, age 72 years. Mr. Webb was born in Nelson, Pa., April 15, 1860, and moved to Brainerd when 19 years old. For many years he was superintendent of the Parker & Topping Foundry and later became interested in the Brainerd Foundry Co.

Edward F. Goes, 73, vice president, Vilter Mfg. Co., Milwaukee, died Aug. 27. Mr. Goes was associated with the Vilter company for 49 years and was vice president for more than 25 years. Before becoming vice president, he was in charge of the purchasing department. A son, Frederick T. Goes, is comptroller of the Vilter company.

Frank Kelly, 74, president, Kelly Foundry & Machine Co., Goshen, Ind., died Sept. 9. Mr. Kelly was born in Toledo, O., in 1858. The Kelly Foundry & Machine Co., was established at Goshen in 1887 by Alfred Kelly and four of Alfred's sons Frank, Charles, Edward and Clark. All of the founders of the company now are deceased. For some time R. B. Kelly has been associated with his father in the foundry.

Magnus Alexander, 62, one of the founders and president of the National Industrial Conference Board Inc., New York, died Sept. 10. Mr. Alexander headed the conference board since its organization in 1916. He was primarily an engineer, but became interested in industrial and economic problems to which he devoted himself almost exclusively for the past 14 years. Mr. Alexander was author of many articles on economic subjects, and also wrote a book entitled "Safety in the Foundry."

Edward Kneeland, 74, formerly an officer in the United Engineering & Foundry Co., Pittsburgh, and one of the founders of the Frank-Kneeland Machine Co., died in Pittsburgh, Sept. 18. Mr. Kneeland was associated with the late Isaac W. Frank, when in 1892 they organized the Frank-Kneeland Machine Co. Nine years later this plant was merged with others in Pennsylvania and Ohio to form the present United Engineering & Foundry Co. In 1901, at the latter company's organization, Mr. Kneeland was elected treasurer and also served as general manager until his retirement in 1923.

Peter Botham, 90, shop superintendent, the Crane Co., Chicago, died recently. Mr. Botham was born in Derby, England, May 22, 1842. He came to America with his parents in 1849 and as soon as he was old enough learned his trade as a molder. In 1863 when he was about 21, he enlisted in the 57th Illinois regiment and served continuously to the close of the Civil war. On Sept. 8, 1865, when the Crane Co. was only 10 years old, he began work as a molder in one of the Crane foundries. In 1881 he had advanced to shop foreman and in 1884 became shop superintendent, a position he held continuously until the time of his death, although during the last few years of his life the position was more honorary than active. His contact with the Crane Co. covered a period of 67 years.

Louis Baden, for many years identified with the Niles Tool Works Co., Hamilton, O., died at his home in that city recently. Mr. Baden was born in Hamilton Oct. 8, 1867. He began work for the Niles Tool Works Co. at 12 years of age, continuing with that firm for 50 years until his retirement on Jan. 1, 1929. He held various positions successively, including assistant foreman of the patternshop, patternshop foreman, foundry superintendent and superintendent of foundry and patternshop which position he held until his retirement. He is survived by his widow, three sons, Raymond, Paul and Louis Baden; one daughter, Miss Dorothy Baden; one sister, Miss Barbara Baden and a brother, Frank Baden, all of Hamilton.

Samuel Lewis Smith, 65, vice president of the National Malleable & Steel Castings Co., Cleveland, and well-known in railroad supply and foundry circles, died Thursday, Oct. 6 following a heart attack. Mr. Smith attended Philips Andover school and Yale university. Shortly after graduation he became associated with the National Malleable & Steel Castings Co. of which his father, Stiles Curtis Smith, was one of the founders. In addition to Mr. Smith's activities with the National Malleable company, he was a director of the Union Trust Co., Cleveland, a member of the executive committee of the Railroad Businessmen's association, a director of the National Industrial Conference board and a director of Eberhard Mfg. Co., Cleveland. He held memberships in many clubs in Cleveland, New York and Chicago and was active in many civic enterprises in Cleveland.

German Foundrymen Hold Meeting in Goslar

The sixty-second annual meeting of the Verein Deutscher Eisengiessereien Giesseiverband (German Foundry Owners' association) was held on Sept. 2 and 3 at Hotel Achtermann in Goslar. At the first session Dr. Aulich, Duisburg, presented a paper on "Rules for Molding Sand Economy on the Basis of Research." The second session was held on Sept. 3 with a paper by Dr. Fritz Schroeder, Bendorf, on "Present Day Cost Determination in Jobbing Foundries." The third session was opened with a speech of welcome by Freiherr von Wittgenstein, and was followed by an address by Dr. Geilenkirchen, Duesseldorf, director of the association, on "Activity and Economic Reports for the Year 1931-32."

Hoffman Foundry Supply Co., 1193 Main avenue, Cleveland, has been formed by Roy S. Hoffman, R. R. Hoffman and L. M. Hoffman to deal in foundry supplies and sands.

IF IT'S A HERMAN IT'S WORTH USING. IT MADE ITS WAY BY THE WAY IT'S MADE

HERMAN MOLDING MACHINES

Various modifications of the above Molding System, using the new HERMAN Hi-Speed Jarr Rollover and Pattern Drawing Molding Machine, have been installed during the last year, with very satisfactory results.

Bulletins H-1, 2 and 4 tell the story. They are yours for the asking.

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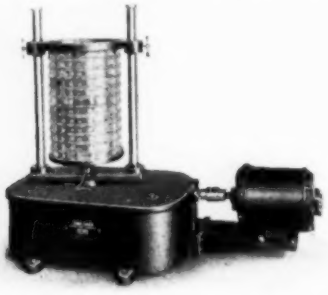
Gibson Battle & Co., Limited, Sydney, N. S. W.

New Equipment

For Foundries

Testing Sieve Shaker Has Two Motions

Newark Wire Cloth Co., Newark, N. J., recently has introduced a new testing sieve shaker as shown in the accompanying illustration. In operation the mounted sieves are given a combined reciprocating and slowly rotating motion, the motor being geared through a worm and wheel. The nest of sieves reciprocates in a direction lengthwise of the gear box. The mechanism is enclosed entirely, and operates in oil to prevent wear



Unit combines reciprocating and rotating motion

of vital parts and also to muffle noises that might be developed. The machine weighs 275 pounds including the motor and switch.

Cost of Cutting Tools

Carboloy Co. Inc., Detroit, has developed a new plan to reduce the price of its cemented carbide cutting tools, which is known as the milled and brazed service. The tools are said to be the same as the regular finished product except they require a small amount of grinding before being placed in operation. Through the milled and brazed service the tools may be obtained at less than the regular finished tool price.

Seals Bearings On Roller Conveyors

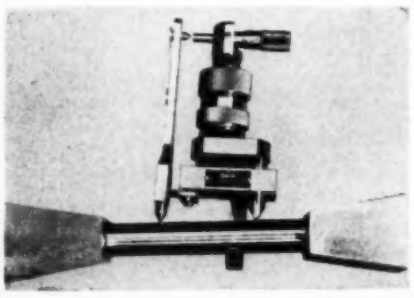
Logan Co., Louisville, Ky., has developed a ball bearing for roller conveyors which is designed especially for use in places where fine abrasive dust is present. A simple labyrinth construction is used, and dust particles which enter the labyrinth are thrown out either by force of gravity or centrifugal force. No part of the shield comes in contact with any other part, and therefore the frictional qualities of the bearing are increased but an exceedingly small amount. The bearings are made in light, medium and heavy sizes.

Determine Yield Point with Extensometer

An extensometer which makes it possible to determine the yield point of specimens being tested in the company's tensile testing machine, has been developed by the Linde Air Products Co., 20 East 42nd street, New York. It is claimed the extensometer is so sensitive it will indicate elongation in a standard A. S. T. M. test specimen occasioned by the heat of the human hand.

Two points of the extensometer are clamped on the specimen to be tested in such a manner that the elongation between the two points during tension is multiplied in a ratio of 5 to 1 by a lever bar making electrical contact with the micrometer head. The moment of contact is indicated by the flash of a small electric light in the extensometer head.

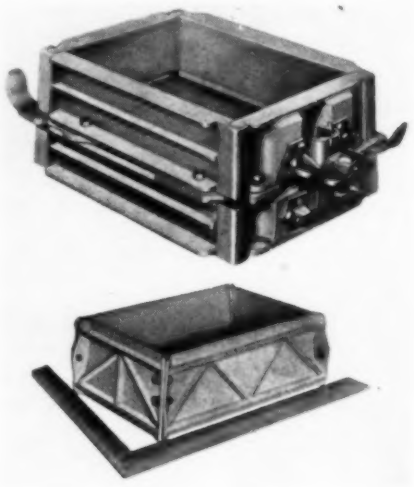
To determine the yield point with the extensometer it is only necessary to back off the micrometer head two complete turns (0.050 inches, which allows for the 5 to 1 ratio in the lever bar) from the zero reading (the point at which electrical contact is broken) for the specimen and apply the load, increasing the tension until the light flashes. The flash indicates that the yield point has been reached, and this may be read from the load indicating device on the tensile testing machine.



Two points on the extensometer are clamped on the specimen

Tapered Slip Flask Is Made of Aluminum

A new slip flask and flexible jacket, designed by Jack Hamel, De-



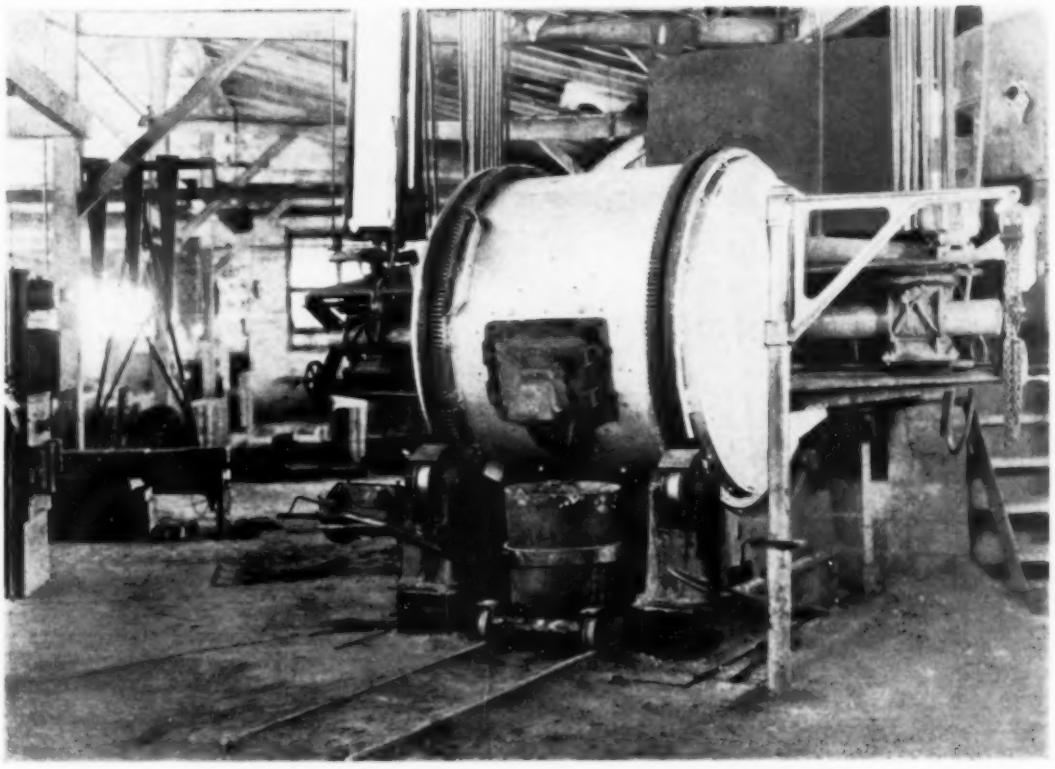
The new tapered flask (above) and the flexible jacket (below)

troit, is being distributed by the Great Lakes Foundry Sand Co., 2100 Penobscot building, Detroit. As shown in the accompanying illustration, the new flask is tapered, is constructed of aluminum and has stiffening ribs to make its sides rigid.

A new feature is the wedged-channel corners, which it is claimed insures square corners. A three-groove flask pin has been adopted as standard equipment, although other types of pins are optional. The three-groove pin has four adjustments to take up for wear or to compensate for differences in plate ears. Pin centers are in excess of the longest dimension at parting line.

The new jacket which is shown in the accompanying illustration, is of the loose bolt type. Ribs are constructed at the corners and on the sides to prevent bulging.

A Metal Melting Machine



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No Miracle . . No Alchemy

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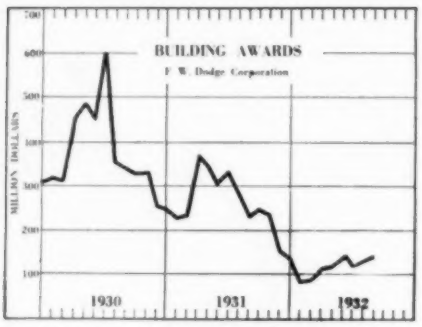
DETROIT ROCKING ELECTRIC FURNACE

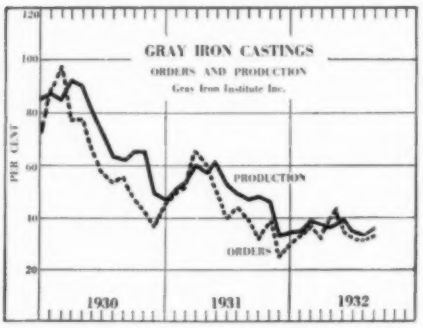
But it does effectively facilitate accurate control of analysis and of temperature, and its rocking action insures homogeneity and absolute uniformity throughout the bath,—all essential factors in the economical production of good castings.

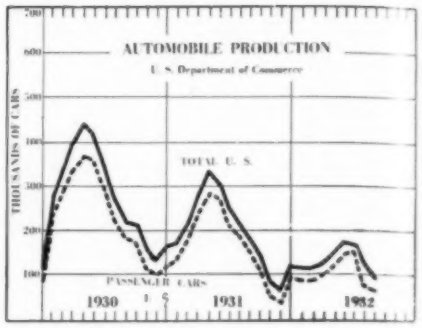
ASK THE MAN WHO USES ONE!

Detroit Electric Furnace Co.

829 W. Elizabeth St., Detroit, Mich.







Foundry Activities

Reflect Industrial Trends

GELLERMAN MFG. CO., Rock Island, Ill., is having plans drawn by Cervin & Stuhr, Rock Island, for a $35,000 foundry to be built adjacent to the plant at 1700 First street. Foundry work now is being carried on in temporary quarters on Twelfth street between First and Second avenues, but it is hoped that the new building will be completed in time for occupancy late this fall. Approximately $10,000 will be spent for equipment.

* * *

Franz Foundry & Machine Co., Barberton, O., has been incorporated by Criss W. Franz, Lillian Olsen and P. H. Stevens.

* * *

Chandler Pump Co., Cedar Rapids, Iowa, is operating its foundry following a shut down of 18 months.

* * *

Machine Steel Castings Co., Alliance, O., has resumed production after three months' idleness.

* * *

Bullen Foundry Co., Butler, Pa., has been incorporated with $5000 capital to manufacture castings and fittings, by F. G. West, Butler, Pa.

* * *

Ralph Brooks and Albert Boulton have started operation of a foundry at Albion, Mich., to manufacture plow points.

* * *

Enterprise Foundry Co., 2902 Nineteenth street, San Francisco, Calif., reports business is better than it has been for the past year.

* * *

Equipment for the Quality Castings Co., a new industry for which the Orrville, O., chamber of commerce raised $10,000 to help finance, is being installed. It is expected to have the plant ready for operation about Nov. 1.

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National Rubber Machinery Co., (DeMattia Bros. plant), Clifton, N. J., has discontinued operation of its foundry at that location.

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Dodge Mfg. Co., Toronto, Ont., has purchased the controlling interest in Canadian-Mead-Morrison Co., Ltd., Welland, Ont. T. A. McAuley, president of the Dodge company, has been elected president of the acquired organization.

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Hardie-Tynes Mfg. Co., Birmingham, recently received contracts for machinery which, it was reported, will insure steady production for some time.

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Louis Bela and Frank Bela will install a foundry in a building which now is being erected by Fred Swartzmiller, South Third street, Chesaning, Mich.

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Detroit Foundry Co. Inc., 1521 First National Bank building, Detroit, has been incorporated to operate a foundry, by Ivan I. Meisner.

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Bond plant of the American Radiator Co., Buffalo, has re-employed several hundred men to produce a new type of home heating boilers, known as the Arco-Petro.

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Ducharme Machine & Foundry Co., Medford, Mass., has been incorporated by George A. Ducharme, George E. Ducharme and Francis X. Ducharme.

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Eagle Foundry Co., Belleville, Ill., manufacturer of gray iron castings, has increased its capitalization from $100,000 to $200,000 to finance expansion of its business.

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Fuller-Warren Co., Milwaukee, manufacturers of stoves and ranges recently has increased its working force and is operating five days a week. The company recently brought out two new range models, following its usual custom, and reports a good reception of the new development.

RAW MATERIAL PRICES
Oct. 5, 1932

Iron	
No. 2 foundry, Valley	$14.50
No. 2 Southern, Birmingham	11.00
No. 2 foundry, Chicago	15.50
No. 2 foundry, Buffalo	16.00
Basic, Valley	15.00
Basic, Valley	14.00
Malleable, Chicago	15.50
Malleable, Buffalo	16.50
Coke	
Connellsville beehive coke	$2.75 to 4.25
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$9.50 to 10.00
Heavy melting steel, Pitts.	9.50 to 10.00
Heavy melting steel, Chicago	5.75 to 6.00
Stove plate, Buffalo	7.25 to 7.50
Stove plate, Chicago	5.75 to 6.25
No. 1 cast, New York	6.00 to 6.50
No. 1 cast, Chicago	6.50 to 7.00
No. 1 cast, Pittsburgh	9.75 to 10.25
No. 1 cast, Pittsburgh	9.75 to 10.25
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	8.50 to 9.00
Car wheels, iron, Chicago	7.00 to 7.50
Railroad malleable, Chicago	6.50 to 7.00
Agricultural mal., Chicago	5.00 to 5.50
Malleable, Buffalo	8.00 to 8.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	6.25
Straits tin	24.30
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt	7.50 to 8.00
Lead, New York	3.25
Antimony, New York	5.62½ to 5.65
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.07½